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PRINCIPLES OF SURGICAL PRACTICE

THE TREATMENT OF FRESH WOUNDS

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INTRODUCTION

THERE are many differences of opinion and of practice with respect to the treatment of fresh wounds. In the past and now these have undoubtedly arisen from a difference in the evaluation of the importance of the various scientific facts and observations concerning the healing of such wounds. To utilize effectively all the knowledge of fresh wounds and their healing is difficult because the overemphasis of one fact in the therapy so readily leads to a sacrifice of other important factors. For example, there was a long period when cauterization dominated the therapy of wounds until, with the help of Paracelsus and Paré, it was proved that the consequent sacrifice of other important facts of wound healing was not justified. It is now beginning to be the feeling that in the past half century the same thing has happened with respect to asepsis and antisepsis, which have monopolized the therapy of fresh wounds. If this is true, it is a duty of the medical profession to subject the present management of fresh wounds to a critical study.

Although there are apparent contradictions when one attempts to employ all the fundamental principles of wound healing in the treatment of fresh wounds, the authors believe it obvious that there must be some compromise in the use of them which will yield the best results.

Judging from past history, as well as from the multiplicity of important facts concerning wound healing, it seems necessary to guard against routines of therapy which inevitably lead to the neglect of many facts and the eventual domination of the therapy by one or two of the more important ones. It seems highly desirable to attempt to initiate a period in which doctors will be freed from routines or fads in the treatment of wounds and will be constantly understanding and critical of the things they do to or for fresh wounds. In the hope of helping to bring about such a period we shall, in this paper, regard the treatment of fresh wounds as essentially a problem in the aid of the activity and growth of living cells which must, in the final analysis, heal the wounds; we shall endeavor to point out how the existing knowledge of wound healing may logically be applied to the solution of that problem. It is obvious that this discussion must be limited to those scientific contributions which, at the moment, appear to the authors to be susceptible of practical application. They readily acknowledge that there may now be some fundamental observations, the practical value of which they do not discern.

It appears to us advisable to list the following facts and observations which should be known by every doctor who treats fresh wounds (not more than six hours old).

1. The proper control of hemorrhage is essential.

2. Prior to the lapse of from six to eight hours the bacteria in a fresh wound may be considered as being on the surface of the wound and not invading the living tissue.

3. The presence of bacteria in fresh wounds may kill living tissue or seriously interfere with its healing by the destruction of the mechanical and nutritional support for the cells of repair.

4. Débris, blood clots, and dead or devitalized tissue markedly handicap the healing of a fresh wound and, besides, encourage tremendously the growth of bacteria and consequently the clinical signs of infection.

5. Fresh wounds, surgical or traumatic, are rarely, if ever, absolutely free from bacteria; their sterilization is relative.

6. Healthy living cells have a remarkable power to combat bacteria.

7. The healing of fresh wounds is brought about by the growth and activity of living cells, save for what is accomplished by contraction.

8. The food for this function of the living cells must, in the final analysis, come from the blood stream and be deposited in the wounds where the cells can utilize it.

9. Granulation tissue is essential to the healing of all wounds.

10. The stimulus to the growth of living cells which heal a fresh wound is probably released by cell damage or promoted by chemical changes which occur at the site of the wound. Some of the substances are believed to be known. The idea of determining them more accurately and of supplying them locally or through the blood stream is intriguing.

11. Dressings and temperature may be a large factor in the healing of fresh wounds.

12. Rest or fixation of a fresh wound lessens trauma which causes necrosis and hemorrhage and opens up avenues for the dissemination of bacteria and their toxins.

The Application of These Principles of Wound Healing to the Treatment of Fresh Wounds

ASEPSIS

It must be assumed that every effort consonant with the surgeon's knowledge will be made to prevent the entrance of bacteria into fresh wounds. This, of course, is asepsis, and, so far as it affects the pre-operative preparation of the skin, will shortly be discussed in this journal. In other aseptic precautions it is essential to watch constantly for inconsistencies which tend always to develop in any operating room.

In spite of scientific studies which were made by Davis and many others, one still encounters throughout this country inadequate masking of the nose and mouth. Even if this be well done, it is not uncommon to see auxiliary nurses and spectators in the operating room without masks.

A few years ago a nurse without a mask came into the operating room to deliver a message and was requested to stop "spitting" into the wound or onto the instruments. Since then, that incident has never been repeated. A great inconsistency is often encountered in the failure to mask the patient, especially when operations are done under local anesthesia. We have seen thyroid patients talking during the preparation of the neck when everybody else in the room was perfectly masked. And the spectacle of an unmasked anesthetist peering over the screen into the wound when all others in the room are properly masked is really ludicrous even though its consequences may be tragic.

In this paper aseptic precautions cannot be fully discussed and need not be inasmuch as, by and large, they are well done and rarely obviate the utilization of our other knowledge with respect to wound healing.

THE CONTROL OF HEMORRHAGE

It is unnecessary to stress the fact that hemorrhage should be controlled both from the standpoint of the life of the patient, as well as of the ability to repair the insult of the wound. Yet it is well to remember that all efforts to control hemorrhage should be counterchecked by a genuine desire to minimize the amount of necrosis in a wound. It was the failure to control hemorrhage which caused the use of the actual cautery to exceed its useful bounds in the days of old. And at the present time it is the failure of this same check which has permitted the use of antiseptics to cause harm to fresh wounds by exceeding their limits of rational usage.

It is quite reasonable to state that the loss of a few drops of blood is less harmful than the tying of a small vessel which will soon stop bleeding of its own accord or under the influence of gentle gauze pressure for a few moments. Ligatures cannot be tied without causing some tissue damage. Yet the surgeon who ligates the individual vessels and excises the projecting ends and who uses gentle transfixion ligatures in an endeavor to avoid mass ligatures will cause the least amount of tissue necrosis.

A word of warning is perhaps in order in connection with the use of the coagulator to stop bleeding. The tendency is to use it freely when a little pressure or waiting for a few moments would often make its use unnecessary. We have seen many wounds so charred by the coagulator and the cautery knife that if they were traumatic wounds, a careful effort to excise the dead tissue would be made. It is well to remember that the damage to tissues from burning extends well beyond the visible necrosis at the time of burning.

Hemorrhage in a wound separates living tissues and increases the amount of work the living cells must do to breach the defect. It is a good medium for the growth of bacteria and thus encourages the development of infection. By tension it may interfere with the blood supply of living cells and retard their growth. It is, in effect, a foreign body which must be removed.

So the ideal control of hemorrhage neither permits the development of a hematoma, nor justifies the use of unnecessary ligatures or coagulation, which introduces foreign bodies into a wound, causes necrosis, and interferes with the blood supply.

CONTAMINATION VERSUS INFECTION

It is generally agreed that prior to the lapse of from six to eight hours, bacteria in a fresh wound may be considered as being on the surfaces of the wound and not invading the living tissues. If this principle is accepted and, also, our belief that all efforts to kill bacteria in a fresh wound cannot be absolutely successful and do unwarranted damage to living tissues, then it is logical to advocate the removal of most of the bacteria from the surface of the wound in a way that will do the least damage to living tissues. In the case of fresh surgical wounds we believe this can best be done by thorough irrigation with normal salt solution; in the case of traumatic wounds this may have to be supplemented by débridement and the use of white neutral soap and water in order to remove the débris introduced at the time of the accident.

BACTERIA

Bacteria in fresh wounds may grow, invade, and kill living tissues and thus seriously interfere with healing. The bacteria utilize the food intended for the growing cells and destroy the fibrinous deposits which hold the cut surfaces in approximation. The products of infection accumulate until the internal pressure breaks down any union which may have been accomplished and the wound is supported by nothing but sutures or epithelium. Pointing is the result of internal pressure necrosis and is Nature's way of draining an abscess. Should the misfortune of a wound abscess appear, a careful surgeon will detect and open it before complete solution of the tissues has again occurred.

It is obviously the surgeon's duty, first to prevent the introduction of bacteria into fresh wounds and, second, to remove as many of them as possible from the surface of the wounds. However, it is essential to remember that fresh wounds can rarely, if ever, be made absolutely free of bacteria; we must accept the principle that their sterilization is always relative. Thus, both the asepsis and the cleansing of fresh wounds should be carried out with the idea that there will always be a few bacteria which the tissues must combat. In this connection it must always be remembered that healthy living cells have a remarkable power to kill bacteria, while dead tissues are helpless against their onslaught.

DÉBRIS, BLOOD CLOTS, DEAD OR DEVITALIZED TISSUE

Many, many times the development of clinical infection is due not so much to the few bacteria which healthy living cells could have handled, but rather to the débris and necrosis left in the wound or produced by the surgeon's roughness, the necrotizing effect of too many tight sutures and ligatures, or the use of germicides which may have destroyed countless invisible delicate living cells. This delicious bacterial food of débris and dead or devitalized tissue is frequently the kindling for a conflagration which need never have occurred. Yet bacteria receive the blame and the conscience of the doctor goes free.

Even if clinical infection does not occur, dead tissues, débris, and blood clots divert the energies of living cells from the problem of repair to the elimination of foreign materials. Tissues long dead in a wound are easily recognizable by their appearance. However, their removal is not sufficient for the treatment of fresh wounds. It is absolutely essential that doctors realize that tissues deprived of their blood supply by trauma, tight ligatures, and sutures, or damaged by germicides must die, even though at the time of operation no apparent changes can be detected in their appearance. *It is our belief that no surgeon has a right to operate unless he has seen or can visualize the appearance of wounds healing by primary intention from five days to a week after they are made.* If you make two similar so-called aseptic wounds upon an animal and in one cause a great deal of traumatism, use many ligatures, and tie sutures tightly, or swab it with a germicide, both of the wounds may heal without apparent infection. However, if those two wounds are again inspected after from five days to a week, there will be a vast difference in appearance. The one with excessive traumatization, strangulating ligatures and sutures, or antisepsis will show much white necrotic tissue, in effect, foreign bodies, while the other may show a uniformly healthy granulating surface. There is no question about which one will show the greatest incidence

of clinical infection and suppuration. Or, to use another illustration, one can repeat the classic experiments of Halsted and others, of producing peritonitis in dogs. The healthy peritoneum can withstand and overcome enormous charges of saline suspensions of bacteria, while if a piece of potato, devitalized muscle, or strangulated omentum be added to the cavity, relatively small doses of bacteria will result in peritonitis.

TISSUE GROWTH

The activity of living cells in the process of healing a fresh wound is really twofold. One feature is the reproduction of fixed-tissue cells which must repair the defect; the other is the activity of wandering cells which must clear the road of all hindrances before healing can be complete. The principal handicaps are non-viable materials and bacteria. The obvious duty of the surgeon is to proceed in such a manner that the work of a wound will be the propagation of fixed-tissue living cells. In other words, the treatment of a wound should be an endeavor to create the ideal conditions for the growth of living fixed-tissue cells. Thus, in a sense, a wound may be regarded as a new growth which the surgeon should endeavor to aid in every way possible, knowing that the process will cease when healing is complete. The effort to adopt laboratory knowledge, gained from growing tissue *in vitro*, is really helpful in the healing of wounds.

BLOOD SUPPLY

Inasmuch as the activity and, in the final analysis, the growth of living cells in a wound are dependent upon the blood which supplies their food, it is essential to neglect no means which will improve the blood supply. The planning of incisions so that all parts of the wound will receive the maximum supply of blood is important. The position of a wound during the process of healing and the period of fixation may make a great difference in the amount and effectiveness of the blood delivered to the wound. When there is great edema of a wound or wounded part not only is the blood supply disturbed, but the coagulum or food for the cells may actually be washed away or markedly impaired by the excessive oozing of serous fluids.

Besides securing for a wound the most ideal blood supply, it is essential to consider the quality of the blood supplied. This may lead to the introduction of fluids until the fluid balance within the tissues appears normal, the addition of blood when there is anemia or septicemia, the intravenous administration of nourishment when there is starvation, or, as recently stressed, the giving of certain salts and biological substances when there is a proven deficiency of them.

GRANULATION TISSUE

A knowledge of bacteria and an interest in aseptic and antiseptic procedures have not eliminated from the process of wound healing the rôle of the granulation tissue. The part of the granulation tissue in the process remains just as important today as it did centuries ago. It is an inevitable concomitant of wound healing.

Besides, in the absence of the normal coverings and linings of the body, granulation tissue is the body's best defense against the invasion of bacteria and toxic substances. Thus, in the treatment of fresh wounds it becomes the doctor's duty to aid, not to jeopardize the functions of granulation tissue. With these ideas in mind he will think twice before he curettes or cuts it away, before he makes it bleed, or before he permits muscular action to damage it.

STIMULUS TO THE GROWTH OF CELLS IN A FRESH WOUND

The origin of the stimulus for the growth of living cells in a fresh wound has not been definitely determined. There is considerable evidence that it is released by cell damage or cell disintegration. *In vitro*, extracts or embryonic tissue of liver and certain other organs will hasten cell growth. It seems reasonable that in a short time the introduction into fresh wounds or into the blood stream of such substances capable of stimulating cell growth will be employed. Already Lanman and others have demonstrated the value to wound healing of Vitamin C in the cases of scorbutic individuals. The stimulating effect of the sulphydryl compounds upon cell growth has been tried out on wounds. There is probably an optimum pH for the growth of cells in a wound. When this is established, efforts will undoubtedly be made to bring it about, either by local or systemic medication. There are other chemical and biological substances which investigators interested in the growth of tissues *in vitro* have found useful. That many of them will soon find practical application in the treatment of fresh wounds seems inevitable.

DRESSINGS

Many plastic surgeons realize that the success of their work depends, in large measure, upon the dressings which are applied to the wounds. If they are too tight, anemic necrosis may result; if too loose, edema and hematomas may cause poor

results. In many instances we would prefer to let the assistant do the operating rather than to apply the dressing.

REST

Fostered by Baron Larry and amply confirmed by Billroth and others is the value of rest to the processes of a healing wound. Motion in a fresh wound brought about by joint or muscular action disturbs the medium in which the cells are growing and invites infection by causing minute hemorrhages and the death of delicate growing cells. Besides, avenues for the spread of the infection may be opened in the granulation tissue. The simple conclusion is that fresh wounds not subjected to the traumatization of activity are much more able to withstand the insults of bacterial contamination. Immobilization of fresh wounds lessens the reaction of wound healing and materially reduces the incidence of clinical infection.

With this general discussion of the treatment of fresh wounds it may be helpful to recite a few cases and then comment upon the procedures employed.

CASE REPORTS

CASE NO. 1. (HOLMES HOSPITAL NO. 380093) The patient, forty-two years old, had exophthalmic goiter and the operation was performed under local anesthesia. After preliminary medication, the patient was brought into the operating room masked as effectively as the operator and his assistants. The neck was carefully washed with white soap and water, alcohol and ether, and then painted with merthiolate. Because of careful pressure tourniqueting, it was not necessary to clamp any vessels during the incision or turning-back of the flaps. Throughout the remaining operation all major vessels were identified and clamped before division, then immediately transfixed and gently ligated. Ends protruding beyond the ligatures were excised. After resection of the gland the patient was asked to cough very forcibly in order to test the hemostasis; any open vessels which bled were carefully ligated. Next, the wound was washed with 1 liter of salt solution poured into it from a height of 18 in. The operator, his assistants, and nurse washed their hands in salt solution and then closed the wound with unused instruments, without any drainage. The last procedure was the careful removal of all air from the wound.

Comment. The patient was masked to lessen the contamination of the wound from his breathing, talking, and coughing. One reason for the local anesthesia was that it required gentle technique if the operation was to be done painlessly; another was that the postoperative reaction and the effect of straining upon the wound from nausea and vomiting were likely to be less. Tissues distal to the ligatures were removed because we knew they would die and become foreign bodies in the wound.

The wound was carefully irrigated before closure because we regarded it as contaminated and believed that most of the bacteria could be washed from the surface. Besides, detached bits of tissue and liquefied fat were also removed by this irrigation. It is surprising the amount of débris and numbers of bacteria which can be removed from such a simple wound if the washings are carefully collected and studied.

A drain was not used because we did not want to introduce a foreign body and thus increase the chances of infection.

The air was removed because it is replaced by serum or blood which separates tissues, complicates wound healing, and enhances the chances of infection.

CASE NO. 2. (HOLMES HOSPITAL NO. 38001) The patient was a fifty-two-year-old woman, moderately stout, with a nine-hour-old, free perforation of a duodenal ulcer. From the history the stomach was free of food at the time of the perforation. The anesthetic was cyclopropane; the skin preparation the same as in the case of goiter. After the incision through the fat and anterior sheath of the rectus muscle, the wound was packed with moist salt sponges and pressed for a few moments. After that it was necessary to tie only a few bleeding vessels. The perforation was easily closed with four Lembert sutures which pulled the stomach over to the duodenum. The free gastric juice and fluids in the abdomen were gently aspirated.

After closure of the peritoneum the remaining wound was treated as a freshly incised traumatic wound. It was carefully irrigated with more than a gallon of normal salt solution. The skin was repainted with merthiolate and redraped. The operator, assistants, and nurse changed gowns and gloves. Sterile instruments and sutures were used for closing the wound. No sutures were placed in either the muscle or fat. The interrupted sutures in the fascia of the muscle were tied very loosely. A moist dressing, kept moist by a rubber protective, was applied.

Following the operation a Wangensteen continuous suction of the stomach was used for two days. Fluids and food were administered by the parenteral administration of salt solution, glucose solution, and blood.

On the fifth day the wound was dressed and the skin sutures were removed. Healing was by primary union with almost no reaction.

Comment. The chances of infection in this case were great. The peritoneum without contamination from food or other solid particles of débris could be expected to handle the insult. The wound was largely freed of contamination by cleansing of its surface and careful aseptic technique. Ligature and suture necrosis was reduced to a minimum. The inevitable necrosis of sutures in the fat and muscle were entirely eliminated. Trauma to the abdominal wound from vomiting was prevented by the Wangensteen apparatus, which also relieved tension and put the gastric wound at relative rest. The blood was kept in the best possible condition to supply food to the growing cells by the parenteral administration of

fluids and nourishment. The first dressing was done on the sixth day when the skin sutures of fine black silk were removed. The healing was by primary union and with no perceptible inflammatory reaction.

CASE NO. 3. (HOLMES HOSPITAL NO. 371033) This patient was a woman of fifty-seven years, with empyema of the gall bladder, gall stones and a pericholecystic abscess. The gall bladder was removed, the cystic duct and artery were ligated with silk ligatures, and six small cigarette drains were placed down to the region of the cystic duct. After closure of the peritoneum the abdominal incision was treated as though it were a freshly incised and contaminated traumatic wound. It was thoroughly washed with salt solution, poured from a height of about 18 in. During the process, the wound was very gently rubbed with the gloved fingers. The skin about the wound was re-sterilized as before the operation was begun. The operators and nurse changed gowns and gloves. Sterile draping was done and clean sterile instruments were used for closing the wound. Sutures were placed only in the anterior sheath of the rectus muscle; these were supported by two stay sutures of silkworm gut, which also served to approximate the fat. A moist saline dressing was applied and not changed for five days, when the skin sutures and a few drains were removed. Healing of the wound was by primary union without any evidence of clinical infection.

Comment. During the first five days the dressings were saturated with blood-tinged drainage fluid and began to smell badly. The temperature, however, was tending downward to normal and the pain was not unusual. The desire to secure for the wound the maximum rest made us choose not to disturb the wound by changing the dressing. It could not be reapplied with the same tension, which, because of the respiratory movements, would have meant extra trauma to the wound. In other words, we regarded the danger of traumatization from changing the dressings more serious than the possible danger of infection from the drainage soaked dressings.

Rest is so essential to the healing of fresh wounds during the first week or ten days (or, until the protection of granulation tissue has formed) that it is difficult for us to justify the changing of dressings until there are indications that something more than that should be done to the wound. Pain, fever, and the patient's general appearance are perhaps the best guides as to whether infection may have reached the point where something more than simple changing of the dressing may have to be done. In that event clinical judgment must dictate when rest shall be sacrificed and new avenues for the spread of infection opened up by changing the dressings in order to see if some other principle of wound treatment is definitely more indicated. Further pursuit of this line of thought would naturally lead into a discussion of the treatment of infected wounds which is not under consideration in this paper.

CASE NO. 4. (CINCINNATI GENERAL HOSPITAL NO. 80740) A white male aged fifteen years was brought to the hospital April 12, 1937. He had jumped from a six-foot wall and landed on a rock which had turned his left-ankle to produce a compound dislocation of the tibia and fibula.

There was a transverse laceration at the level of the internal malleolus through which the lower end of the tibia protruded. The exposed parts were extremely dirty where the joint surface had struck the ground. The astragalus had become dislocated lateral to the fibula and had carried with it a tip of the lateral malleolus, although the fibula had not been torn from the tibia. The skin edges, which were tightly stretched about the end of the tibia, served to protect the astragalus and deep aspects of the wound.

The leg was washed with soap and water, shaved, scrubbed, washed with alcohol and ether, painted with an antiseptic, and draped. A thorough débridement was done under general anesthesia and a tourniquet. The soft tissues were trimmed away at the edges of the wound. The dirty periosteum and bone, and cartilage on the articular surface were shaved off with a chisel. Areolar tissue from tendon sheaths, nerves, and vessels was carefully dissected off. After all gross dirt had been removed, the wound was washed with large quantities of warm saline. The parts were rubbed gently with a gloved finger to remove bits of clot and tissue. When the cleansing was satisfactory, the tourniquet was removed and active bleeding points were ligated with fine silk.

The dislocation was reduced and the wound closed with silk. A padded dressing was applied and the ankle placed in inversion to release tension on the suture line.

The only immediate postoperative complication was a serum rash, which produced a fever of 103° on the sixth day. After the ninth day the temperature was normal.

The foot lost some of its inversion in the padded cast, and produced excessive tension on the suture line so that a dry necrosis occurred at one point along the edge of the distal skin flap. The wound was not disturbed for two months for fear of breaking this protecting crust. Then the manipulation of applying a fresh cast was followed by a crack in the crust, slight local cellulitis, regional lymphadenitis, and general malaise. A wet dressing was placed on the crust, which came away to reveal a nicely granulating wound beneath. The fever subsided and the wound healed promptly.

At present the ankle is well stabilized; the foot gives no pain, is used without any support, and causes no easily detectable limp.

Comment. The débridement of dirty bone and cartilage by sharp dissection was as important as it is in soiled and devitalized soft tissues. The good result in this case depended on more than an adequate débridement. In fact, a disastrous result seemed imminent when the gangrenous skin tip was discovered and was threatening to break open. The break was avoided by aseptic handling of the wound until the damaged skin became dry and formed a sterile crust, by sufficient immobilization to prevent cracking of the crust and agitation of the healing surfaces within the joint, by slight elevation of the part to lessen the edema, by avoidance of frequent dressings

and any manipulation until it seemed evident that good granulation tissue should be present below the crust and protecting the rest of the wound.

The severe and frightening reaction which did accompany the delayed manipulation clearly demonstrates the advantage of rest and the damage which results from movements which break open avenues of absorption.

CASE NO. 5. (DEACONESS HOSPITAL NO. 2456) A young girl of fourteen years received in an automobile accident an extensive laceration and contusion of the left thigh. A large triangular flap of skin and muscle was turned upward from just above the knee. The wound extended from the mesial side of the thigh across the top to the lateral aspect where it met a vertical laceration which extended upward for more than 6 in. The muscles were torn and loosened up as far as the greater trochanter and exposed the bone, from which a considerable area of periosteum had been removed. The tissues were badly stained and there were many stones of varying sizes throughout the extent of the wound. After a painstaking irrigation, débridement, washing with soap and water and again with salt solution, requiring more than an hour, the triangular flap of skin and subcutaneous tissue was gently laid back and sutured with three sutures which failed by 1½ in. to approximate the skin edges. No buried sutures were placed in the wound. A moist dressing was applied and the leg was encased in a large plaster spica which included the abdomen and foot. Although this patient was unconscious from a concussion of the brain and incontinent for three days during which the dressings became soaked with urine, another dressing was not made for ten days. Healing was by first intention except for the gaping, where there was healthy granulation tissue.

Comment. In many instances in which no attempt at closure is made, the wound, after the preparation described, is filled with vaseline, dressed, and immobilized for many days without even inspection unless pain or fever may indicate an infection for which the tissues may need some help other than the rest. During this time the wound's best protection, granulation tissue, forms. After that other measures to hasten healing or epithelization may be indicated.

CASE NO. 6. Not long ago a friend of mine brought his son hurriedly to my home because of a laceration of the end of his thumb. If the boy had not held his wound under running water the father would not have been so worried; he would have put some iodine on it and wrapped it up. As it was, he was very afraid of an infection from the water. You can imagine his surprise when, after cleansing the skin about the wound with benzine and then cutting away some dead fragments of skin, I gave the boy a stool by the sink and told him to run warm water on the wound. After the lapse of ten or fifteen minutes a large amount of vaseline was placed on the wound and secured in place by a soft dressing incorporating a splint to immobilize the thumb. The hand was placed in a sling and the father was instructed not to bring him for an inspection of the wound for a week unless he should show an elevation of temperature or complain of pain. No antiseptics were used in the open wound. There was practically no pain and no fever. At the end of a week the wound was healed. The father, like thousands of other people of our generation, had been imbued since birth with the necessity of using iodine or some antiseptic to kill the germs in such a wound. He had never seen a wound like that heal without getting red and painful. He didn't know why I had used a splint, why the hand was put in a sling, or why the fragments of dead tissue were cut away. To him the one essential on such an occasion had always been to kill the germs at whatever cost in pain, suffering, and infection. He could only shake his head and say, "I do not understand."

Comment. This father's attitude reflects, we believe, the viewpoint of the average layman today with regard to the handling of trivial wounds and probably that of the vast majority of the doctors of our time with respect to all wounds.

This case has been cited because there are many conditions and circumstances under which the ideal therapy of fresh wounds is impractical. Under such circumstances the only course of procedure is a logical compromise with one's ideals. First, however, those ideals must be founded upon a thorough knowledge of the principles of wound healing and of the indications for their use.

SUMMARY

In this paper we have endeavored to list the most important principles of wound healing and to indicate by discussion and case reports how these various principles may be logically employed in the treatment of fresh wounds.

SURGERY OF THE HEAD AND NECK

HEAD

Ersner, M. S., and Myers, D.: Treatment of Thrombosis of the Lateral Sinus Without Ligation of the Internal Jugular Vein. *J. Am. M. Ass.*, 1937, 109: 919.

The authors believe that treatment of infection of the lateral sinus is primarily medical and only partially surgical. Among the medical measures, transfusion of whole blood is important. Small amounts, 1.5 to 2 c.cm. per pound (0.5 kgm.) of body weight, are given daily or on alternate days. Specific serum should be used when it is available. Sulfanilamide has been reported during the past year to be strikingly beneficial.

The surgical principles advocated are the institution of drainage and the avoidance of overmanipulation. Thrombectomy is not indicated when the thrombus is firmly fixed. These principles are based on the belief that thrombosis is a protective process and on the conclusion that ligation of the internal jugular vein is not a panacea in the treatment of infection of the lateral sinus.

WALTER H. NADLER, M.D.

Rosedale, R. S., and Koepf, S. W.: Non-Tumorous Cysts of the Maxilla: Interesting Cases and Discussion. *Ann. Otol., Rhinol. & Laryngol.*, 1937, 46: 652.

The authors discuss the etiology of maxillary cysts, and the origin of the cystic fluid which they believe is a transudate rather than a secretory product of the epithelial lining. The cysts under consideration are all originally situated in bone, and as they enlarge they cause bone atrophy, which is characterized by halisteresis and osteoporosis. The bone is distended until finally the cyst may be limited by only a thin cortical shell. Very large cysts may perforate the outer cortical plates in the canine fossa and be limited only by soft tissue. They may cause the floor of the orbit to be raised, the malar eminence to be hollowed, the palate to be extended downward, the outer plate of the labial alveolar process to bulge forward with protrusion of the lip, or the opposite maxilla to be encroached upon when the cyst is located in the anterior part of the upper jaw. Encroachment upon the maxillary sinus is common and often associated with medial displacement of the lateral nasal well.

The diagnosis is not difficult. Slowly growing tumor masses, such as odontomas, cystic adamantinomas, or deep malignancies, such as carcinoma of the antrum, must be considered in the differential diagnosis. Palpation and aspiration give valuable information. The former may give a sensation of crepitus; the latter will yield a clear fluid containing cholesterol crystals. X-rays will aid generally, and should be used routinely, as well as biopsy examination, particularly to exclude adamantinoma, even though the diagnosis is apparent.

The treatment should consist of removal of the cyst by blunt dissection through intra-oral incision over the point of swelling. The remaining cavity is then connected to the nose through a large sized window under the inferior turbinate, after which procedure the first incision is closed by sutures. This type of treatment tends to result in less deformity and discomfort and in more rapid healing than treatment by packing and irrigation through the intra-oral incision.

Seven cases of non-tumorous cysts of the maxilla, illustrated by roentgenograms, are discussed. Of these, 6 presented perforations of the outer cortical plate of the maxilla, resultant facial deformity, and encroachment of the cyst upon the antrum. In 3 the cysts were more advanced, with bilateral antral involvement; 2 of the cysts were follicular cysts, 1 without teeth; the other one was associated with an antral odontoma.

KURT H. THOMA, D.M.D.

EYE

Jameson, P. C.: The Surgical Management of Ptosis, with Special Reference to Use of the Superior Rectus Muscle. *Arch. Ophth.*, 1937, 18: 547.

Many different procedures have been described for the surgical treatment of ptosis, which indicates that no one operation is suitable for all types of cases. A survey of the conditions present should permit differentiation between the various types of ptosis—the congenital or partial paralytic and the non-paralytic, the obstructive, integumentary, trachomatous and symblepharon types, and the types which impart bulk to the lid.

Jameson describes measurements and relationships which have not been described in relation to ptosis, the first of which is the relation of the margin of the upper lid to the globe. The margin is always found on a line midway between the pupillary margin and the upper limbus, a relationship scrupulously maintained in the primary position in a normal person. The drop below this line in millimeters is the amount of the ptosis.

The second and third measurements are the vertical and horizontal measurements of the palpebral opening, normally 9 mm. and 27 mm., respectively. A reduced horizontal measurement may indicate the necessity for a canthotomy.

The fourth measurement is the distance between the margin of the lid and the arch of the eyebrow with the eyes in the primary position. In the normal young subject this measurement varies from 15 to 18 mm., whereas in congenital ptosis it may be from 25 to 30 mm.

The fifth measurement is the vertical distance from the margin of the lid to the top of the superior tarsal arch, normally 8 mm. in the adult.

The behavior of the ptosis in the upward and downward gaze should also be noted. These observations are a guide to the selection of the operation and the amount of correction to be undertaken.

Some of the operative procedures are discussed briefly. Cleancut oval excisions are valuable when redundant integument exists, or to supplement other procedures. They heal inconspicuously with subcutaneous sutures. The flap-tucking, transplanting cutaneous operations are often attended by ugly puckering, with the possible exception of the Hess operation.

In cases of moderate ptosis without excessive weight, operations for tarsal resection, such as that of Gillet de Grandmont, are excellent if there is still some action of the levator muscle. Suture operations relying on the irritation produced by the transit channel to contract and hold the drooping tissues are usually disappointing.

Among the operations best calculated to correct the heavy lid is the Fergus operation, which is the direct transplantation of a tongue of the occipitofrontalis muscle into a pocket between the tarsus and the orbicularis muscle. A better procedure is the operation of Eversbusch, in which the tarso-orbital fascia and adjacent tissues, including the levator muscle, are folded into a pocket on the surface of the tarsus. Another one is the Hess operation in which the skin is tucked from the under surface, and the tarso-orbital fascia is approximated to the occipitofrontalis muscle.

Motais was the first to practice the operation which gave mobility to the lid by means of the superior rectus muscle. A tongue of the muscle 3 mm. wide and 10 mm. long was dissected out and passed through an incision through the tarso-orbital fascia and the levator muscle, drawn into a pocket between the orbicularis muscle and the tarsal surface, and, finally, anchored 2 mm. below the curve of the tarsus.

Parinaud modified the procedure to allow gradation of the operation, having for its object the direct attachment of the unmutilated muscle to the arch of the tarsus, with no dissection of the tongue. Jameson thinks that operations based on the Parinaud conception are much stronger than the Motais operation and that the Parinaud procedure insures a larger return of correction.

Jameson reports a procedure which he has used in 8 cases with good results. It embodies the following principles: (1) the use of the entire strength of the unmutilated superior rectus muscle, (2) a direct incision into the cartilage with entrance into a pocket prepared for the reception of the folded muscle, instead of the incision into the levator muscle or the tarso-orbital fascia and then into the post-orbital region, (3) shortening of the muscle and consequent elevation of the lid by the folding of the attached muscle on itself prior to its introduction into the pocket with the addition of elevating the tarsus by placing the incision in the cartilage farther below the curve, and (4) the secure attachment of a folded shortened muscle.

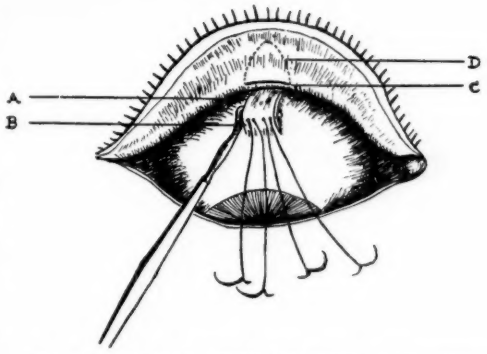

Fig. 1. After the lid is everted the superior rectus muscle is dissected out but not detached (A). Two double-armed sutures are introduced from under the surface; the farther back on the muscle these are introduced, the greater the shortening (B). An incision is made directly into the cartilage about 2 mm. below the upper surface of the tarsus (C). A pocket is made between the orbicularis muscle and the tarsal surface (D).

The approach is entirely from the conjunctival side. The superior rectus muscle is dissected free, but not detached. Two double-armed sutures are introduced, gradation of the shortening being possible by variance in the location of these sutures. An incision is made directly into the cartilage, large enough to admit the muscle into a pocket prepared for it. The muscle is overlapped on itself by drawing the sutures and muscle into the pocket, securing it there by passing the sutures through to the margin of the lid, and tying them on bolsters.

Further gradation can be obtained by making the incision farther down in the tarsus, and by approximating the muscle nearer to the intermarginal space by traction. EDWARD S. PLATT, M.D.

Arruga, H.: The Treatment of Detachment of the Retina. *Arch. Ophth.*, 1937, 18: 501.

Arruga believes that more ophthalmologists should undertake the operative treatment of retinal detachment, since, from a humanitarian standpoint, it is better to achieve cures in 50 per cent of all cases than in 70 per cent of the cases in the hands of a very few experienced surgeons. He believes that emphasis should be placed upon careful ophthalmoscopic examination and that careful and accurate localization of the retinal tear will improve the prognosis in from 20 to 25 per cent of the cases, for it is then not necessary to do such an extensive operative procedure with consequent damage to the ocular function. A schematic drawing of the fundus findings should be made. Frequent ophthalmoscopic examinations during the course of operation will help to control

the operation and orient the surgeon after his first punctures are made. Transillumination may be helpful in localizing the tear. The light of the ophthalmoscope may be fixed on the tear while the assistant notes which part of the sclera is illuminated; or, the transilluminator may be used on the sclera and the assistant may observe, with the ophthalmoscope, the point at which the tear is illuminated.

At the present time diathermy is the method of treatment in most general use; it is preferable to the original cautery method of Gonin, or the chemical cauterization method of Lindner and Guist. Both surface diathermy and perforating diathermy are used, the choice depending upon the type of detachment that is present. In cases of large, bulging detachments, both forms may be used jointly. It is important that subretinal fluid does not remain at the conclusion of the operation, as this will prevent the formation of adhesive chorioretinitis.

Following the operation, it is important to bandage both eyes and to keep the patient in bed for several days. If necessary, the operation may be repeated after twelve days.

Many factors in the pathogenesis of detachment of the retina are still not fully understood. The tear undoubtedly plays a great rôle, but there are probably several means by which a detachment may be produced. These are described in detail.

WILLIAM A. MANN, JR., M.D.

Dunnington, J. H., and Macnie, J. P.: Detachment of the Retina: Operative Results in 164 Cases. *Arch. Ophth.*, 1937, 18: 532.

The authors report the results obtained in 164 patients who were operated upon for detachment of the retina. Sixty-seven per cent of the patients were males, and this greater percentage of males is partially accounted for by the higher incidence of trauma in the males. There was a definite history of trauma in 17 per cent of all cases, and an indefinite history of trauma in 13 per cent. Cure was obtained in 62 per cent of the patients giving a definite history of injury. Ages varied from six to seventy-nine years. In 31 patients, both eyes were involved. Some degree of myopia was present in 53.8 per cent of the patients, and a myopia amounting to at least 6 diopters was present in nearly a third of the patients.

Hypotonia was found to be a grave prognostic sign. Improvement was obtained in 68.5 per cent of cases in which one-half, or less, of the retina was detached, whereas, in cases in which three-fourths or more of the retina was involved, only 25 per cent were improved by operation. In one-half of all of the cases, the inferior portion of the retina was detached.

Cases in which no tears were found responded as well to operation as those in which retinal holes were discovered prior to operation, although widespread treatment of the affected area by diathermy was employed in all cases.

A total of 171 eyes were operated upon, with cure in 42.1 per cent, improvement in 8.2 per cent, and failure in 49.7 per cent. Advanced age, high myopia, aphacia, hypotonia, extensive detachment, and large or multiple tears influenced the prognosis unfavorably.

WILLIAM A. MANN, JR., M.D.

EAR

Sourdille, M.: The Present Position of the Surgical Treatment of Otosclerosis. *Proc. Roy. Soc. Med.*, Lond., 1937, 30: 1519.

The author states that for the time being one must operate only in cases of primary otosclerosis accompanied by ankylosis of the stapes, i.e., the tympanolabyrinthic form with negative Rinne and prolonged Schwabach reactions. Operation must not be performed in cases of secondary otosclerosis with even slight inflammation in the tympanum, as in these cases there is a great risk of consecutive necrosis of the incus and labyrinthine infection.

One must not wait too long before proposing the treatment. As a rule, the hearing is definitely improved by operation, and is from ten to twenty times more powerful than before.

If the operation is performed at an early stage, for example, when a low voice can still be heard at 1 m., restitution to normal may be expected. However, most of the patients refuse the operation at that stage, and accept it only much later when their hearing is more severely impaired. If a loud voice cannot be heard beyond 0.5 m., the results will not be completely satisfactory, but with some aid the patient will be able to resume his ordinary life.

JAMES C. BRASWELL, M.D.

MOUTH

Bucalossi, P.: The Treatment of the Lymphatic Glands in Cases of Malignant Epithelial Tumors of the Oral Cavity (Il trattamento dei gangli linfatici nei portatori di tumori epiteliali maligni del cavo orale). *Tumori*, 1937, 23: 594.

The author presents a complete discussion of the anatomy, pathology, and clinical indications for interference with the regional lymph nodes in the treatment of malignant lesions of the lips and cheek. A number of case reports are included.

Early radical surgical intervention is the treatment of choice in the attack on the local lymphatic drainage of malignant growths of the lips and cheek. A detailed discussion of the rationale of the surgical attack on the submental, submaxillary, and superficial parotid lymph nodes is presented.

Radiological treatment should be reserved for those patients in whom there is a definite contraindication to operation, or for those in whom the lymph nodes are inaccessible to surgical attack. As a complement to extirpation, radiation remains valuable.

A number of figures with detailed explanations supplement the report.

A. LOUIS ROSI, M.D.

Meleney, F. L.: The Use of Zinc Peroxide in Oral Surgery. *Internat. J. Orthodontia & Oral Surg.*, 1937, 23: 932.

The alimentary tract of man normally contains many organisms. These are constantly being introduced with food and other objects that are put into the mouth. The predominating aerobic organism in the mouth is the green streptococcus. We do not ordinarily think of these bacteria as being present, or as being of much importance in the mouth, but under certain circumstances such organisms play an important rôle in infections which result from a contamination of the tissues with mouth organisms.

Infection may occur when the first line of defense has broken down, namely, when there has been a break in the continuity of the surface epithelium as the result of a wound caused by some sharp object, or as the result of chemical erosion of the surface epithelium, or by direct invasion of the mucous membrane by certain pathogenic organisms. When a tooth is extracted, there is invariably an injury to the surface mucous membrane and a break in the surface of the tooth socket, and contamination of these surfaces with the mouth organisms occurs immediately. Of great importance, then, are (1) the restriction of injury to the tissues, and (2) the restriction of the number of contaminating organisms.

Infection may spread by three routes: (1) by means of the lymph channels, (2) by means of the blood vessels, and (3) by means of direct extension. The lymphatics of the oral cavity drain into the collar of lymph glands below the jaw. The blood vessels of the oral cavity also serve as a route by which infection may spread, chiefly along the venous branches which follow well known anatomical distributions. Of particular importance are communications between these vessels, in which there are no valves, and the ophthalmic veins, because if there is any blockage to the downward flow of blood it may flow back through the pterygoid plexus into the inferior ophthalmic vein, through the angular vein at the inner angle of the eye into the superior ophthalmic vein, and thus into the cavernous sinus.

The fascial spaces of the face and neck also direct or limit the spread of infection.

Anaerobic and micro-aerophilic organisms play a prominent part in inflammatory processes in the gums, as in pyorrhea, or in ulcerated infections of the tongue and cheek which are commonly called stomatitis.

The hemolytic streptococcus commonly produces a diffuse cellulitis of the tissues of the throat and, not infrequently, spreads to the neck, and closure of the glottis is frequently threatened or produced by the rapid development of edema, but there is usually no necrosis of the mucous membrane or of the deep tissues of the neck. Usually, the hemolytic streptococcus infections produce a high fever and a profound intoxication, while infections due to the anaerobic and micro-aerophilic organisms produce less fever and less intoxication, but a more distressing and extensive destruction of tissue. The hemolytic streptococcus infections are likely to arise acutely and to subside rapidly, while the micro-aerophilic and anaerobic infections are more apt to develop slowly, spread insidiously, and resolve less rapidly.

When aerobic organisms are present in the mouth unaccompanied by any inflammation they may be restricted or eliminated by a number of oxidizing agents, such as potassium chlorate, potassium permanganate, or sodium perborate, but they are more quickly and more effectively eliminated by the use of zinc peroxide. When, however, there is an infection, either mild or grave, with an invasion of the submucous tissues and superficial ulceration of the mucous membrane, zinc peroxide is much more effective in treatment than are other oxidizing substances. When the infection has spread to the deeper layers, radical surgery is required. After the tissues have been opened up by adequate surgery, however, the infection can be brought under control by the careful application of zinc peroxide suspended in sterile distilled water to every part of the infected surface.

The zinc peroxide must be an effective preparation, as shown by preliminary tests indicating its ability to liberate oxygen when suspended in distilled water. Only the "medicinal grade" should be used. It should be sterilized in small quantities for four hours, at 140° C. dry heat, and applied as follows:

The dry powder is suspended in approximately an equal quantity of water so that it has the consistency of 40 per cent cream. It can be mixed nicely with an asepto syringe and applied with the syringe to every part of the wound surface. If there are any sinuses, it should be delivered into them with a catheter; but if there are any parts of the infection which cannot be reached, the wound will have to be opened so as to permit contact, which is essential. When the whole surface of the wound has been covered, fine meshed gauze which has been soaked in zinc peroxide should be placed over the surface, and the whole wound sealed with several layers of vaseline gauze to prevent evaporation. The dressing should be changed daily. The zinc peroxide—about one part of powder to four parts of water—should also be used at the same time as a mouth wash.

LOUIS T. BYARS, M.D.

NECK

Lahey, F. H.: Pulsion Esophageal Diverticulum. *J. Am. M. Ass.*, 1937, 109: 1414.

A pharyngo-esophageal diverticulum is a protrusion of the mucosa and submucosa of the hypopharynx through the muscular wall of the hypopharynx. The sac lies between the pretracheal and prevertebral fascia, and its neck is surrounded by fibers of the inferior constrictor muscle and the muscle which splits off from it obliquely to extend down the esophagus, the cricopharyngeus muscle. This muscle's relationship to the neck of the sac is of the utmost

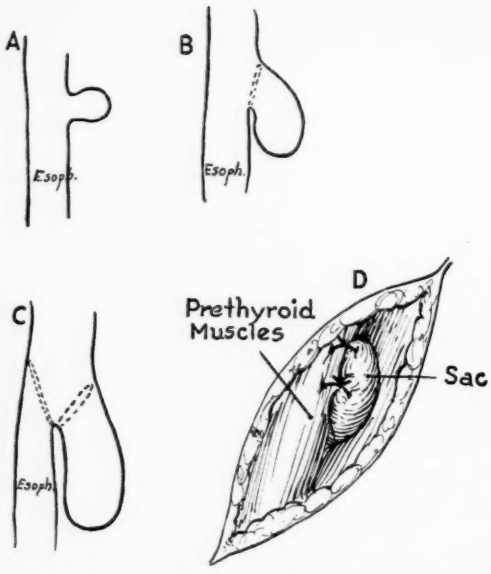

Fig. 1. A, B and C demonstrate how the opening into the sac changes position as the sac enlarges. In the early sac the opening is directly lateral, as in A; as the sac becomes larger and descends it becomes a little more oblique as in B, and as the sac becomes still larger and descends into the mediastinum, as in C, the opening into the sac and the previous transverse opening into the esophagus become oblique. By the traction of the food-filled sac the edges of the opening into the true esophagus are brought together so that the opening appears as a mere slit. D shows the method of suturing the sac with black silk stitches to the outer and upper edge of the sternohyoid muscle and also the plan of implanting the sac in the upward direction so that, between the first and the second stage, food will not pass through it.

importance, since unless the constricting muscle fibers about the neck of the sac are accurately removed, the sac is quite apt to recur.

In a study of 53 patients operated on more than two years previously in the Lahey clinic, the symptoms in the order of frequency were: difficulty in swallowing, regurgitation, gurgling noises in the neck (40 cases), attacks of strangling or coughing, and loss of weight. Two patients had pulmonary abscesses which required drainage before the cervical operation.

The successful operative treatment involves the complete removal of the constrictor-muscle fibers from about the neck of the sac and the protection of the patient from the development of cellulitis between the prevertebral and pretracheal fascia and extension of this infection into the mediastinum. The two-stage operation has been found most effective as in the entire series no mediastinal infection was observed. It was not found necessary to pass the esophagoscope into a diverticulum in any case. Cervical block anesthesia with procaine hydrochloride was employed and the patient could assist by swallowing during the operation. Lahey's plan of operation involves implanting the sac of the diverticulum in the wound between the first and the second stage of the operation so that it points upward and food cannot enter the sac, and swallowing is immediately unobstructed. Another plan involves burying small diverticular sacs in the wound by attaching the tip of the sac to the upper edge of the thyrohyoid muscles by two black silk stitches as shown in Figure 1. This makes it possible to do a two-stage operation on any diverticulum no matter how small if it has a sac, and, by the employment of the black silk stitches, to find readily the tip of the sac in the granulating wound when it is reopened at the second operation.

Postoperative dilation with a modified Plummer bag has been a factor in the improved results. In 5 of 53 patients the left recurrent laryngeal nerve was injured but paralysis was permanent in only 1. In 18 cases a fistula followed resection of the sac. These were early cases in which the esophagus was left open and covered with gauze to allow for closure by granulation. Since implanting the sac high in the neck little trouble from fistulas now results. A secondary abscess developed in the wound in 5 cases. All these abscesses ruptured or were drained and healed. Difficulty in swallowing developed between the first and second stage because of the accumulation of air in a large sac. This was overcome by suturing a catheter into the dome of the sac and guiding it into the esophagus. Two patients had a recurrence of the sac because of inadequate primary removal. One was re-operated with complete relief. The other refused re-operation. Two patients have had partial recurrence with some symptoms. Nineteen patients showed some retention of bismuth in the hypopharynx on x-ray examination, but 11 were free from symptoms. In 2 cases the second stage was not done. One death resulted from uremia. In the other case complete relief was obtained. Three years have now elapsed since the operation. Lahey suggests that in the very old and in patients who are bad risks the simple freeing of the sac and high implantation is sufficient.

MANUEL E. LICHTENSTEIN, M.D.

SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Loehr, W.: The Value of Arteriography in the Neurological Diagnosis of Head Injuries (Die Bedeutung der Arteriographie fuer die neurologische Diagnostik bei Schaedelverletzten). *Deutsch. Mil. arzt.*, 1937, 2: 49.

Loehr decries unscientific criticism of arteriography and endorses, in large measure, the practical and pathologicophysiological significance of this technique which is finding more widespread use. He also discusses its value in cases of head injury based on individual observations. In cases of concussion he finds that the vascular system of the brain is topographically normal, but the vessels appear to be in a marked state of contraction, similar to that seen in the increased intracranial tension of hydrocephalus. In cerebral contusion, there appears to be a loss of vasomotor tone. The picture may look singularly worse during the so-called capillary phase, in which the individual vessels are widened and flattened, and only partly filled. The veins are also filled. Cerebral compression following meningeal hemorrhage shows a typical picture. There is a compression of the anterior cerebral artery on both the injured and the normal side, which often fills on the normal side, from an injection on one side. There is a narrowing of the normal right angle existing between the anterior and middle cerebral arteries by elevation of the peripheral branches of the middle cerebral arteries; and a compression of the finer branches of the middle cerebral artery from the vault of the skull, by the separation of the dura, occasioned by the hematoma. In the lateral view one may observe an engorgement and compression of the carotid siphon, and elevation of the first and second thirds of the Sylvian vessels. The film will will also give an indication of the size of the epidural hematoma.

The injection is made into the internal carotid artery, as it is not possible to inject directly into the torn middle meningeal vessel, or to reach the hematoma by an injection into the external carotid artery. In contrast to the tumors of the temporal bone, differential diagnosis must be made from compression of the branches of the middle cerebral artery by the bony vault. The author observes that epidural hematomas develop very rapidly, much more rapidly than one would expect from the rise in the intracranial pressure. This is emphasized by three case histories. Two of the patients were operated upon too late, while the third was admitted to the hospital in a hopeless state. Epidural hematoma was given as the cause of death in all three cases. The author warns against the indiscriminate use of lumbar and sub-occipital puncture in these cases, as he has seen two deaths following these maneuvers. Subdural hemorrhages following rupture of cerebra vessels can also be demonstrated by arteriography

In conclusion, the author points out the difficulties in diagnosis which determine the therapy and the prognosis. He believes that arteriography may be of great help in cases of head injury, which are growing in frequency. With the advances in motorization of the armies, head injuries will be much more common in future wars.

(WANKE). WILLIAM C. BECK, M.D.

Olivecrona, H.: Blood-Vessel Tumors and Blood-Vessel Anomalies of the Brain (Ueber Gefaessgeschwuelste und Gefaessmissbildungen des Gehirns). *Orvosképzés*, 1936, 26: 778.

The author divides the vascular tumors of the brain into four groups, partially according to the classification of Virchow: (1) angioma cavernosum (with the subgroupings of telangiectasia and Sturge-Weber's syndrome); (2) racemose angioma (arterial, venous, arteriovenous); (3) angioreticuloma; and (4) angioglioma. The cavernous angioma is rare and is of little clinical importance.

The author, following Bergstrand's suggestion, defines the Sturge-Weber syndrome as a vascular anomaly in which there are typical calcium deposits in the brain, which can be demonstrated roentgenographically. These deposits cause epileptiform convulsions, and are associated with a nevus flammeus in the face and often a glaucoma. The calcium deposits are in the cortex of the brain. The disease should be considered a vascular anomaly, which primarily affects the smaller vessels of the brain, the pia mater, the eye, and the skin.

Of the racemose angiomas, the arterial type is very rare, or perhaps never occurs. The venous type may appear as a simple varicosity, or it may form a knot of vessels. Should such a knot of vessels be nourished by arterial blood, then the angioma may be considered as an arteriovenous type.

The angioreticuloma is a tumor and occurs almost exclusively in the cerebellum. Lindau's disease is the description of a triad of symptoms which arise from an angioma reticuloma in the cerebellum, an angioma in the retina, and cyst formation in the pancreas or kidneys.

The angiogliomas described by Oberling and Roussy are of more pathological than clinical interest.

The author's material included a total of 1,146 histologically proved brain tumors, 581 (50.7 per cent) of which were gliomas, 207 (18.06 per cent) meningiomas, 121 (10.6 per cent) neurinomas, 82 (7.2 per cent) adenomas, 21 (1.8 per cent) craniopharyngiomas, 10 (0.9 per cent) cholesteatomas, 4 (0.3 per cent) teratomas, 49 (4.3 per cent) angiomas, 6 (0.5 per cent) papillomas, 19 (1.7 per cent) granulomas, and 28 (2.4 per cent) metastases.

Of 6 patients with Sturge-Weber's disease 1 was cured, 1 markedly benefited and the other 4 were treated too recently to permit determination of the result.

In 19 cases of arteriovenous aneurysm, the diagnosis was verified by arteriography. Therapy is possible only if all of the afferent arterial branches can be ligated. This is often not possible as it would occasion too much damage to the brain tissue. The author could accomplish ligation of the afferent vessels in only 6 cases.

The angioreticulomas comprised 13 per cent of all of the cerebellar tumors. The average age of the patients was thirty-eight years. After general pressure symptoms the most important were those of vestibulocerebellar disturbance. Impaction symptoms were common.

Radical surgery was the therapy of choice. In 16 cases there were 2 deaths, one following pulmonary embolism, the other from meningitis. Fourteen patients were cured. The prognosis of these tumors is, therefore, excellent.

(Kessel). William C. Beck, M.D.

Oldberg, S.: An Attempt to Explain the Quadrantanopsia in Tumor of the Temporal Lobe (Versuch zur Erklaerung der Quadrantanopsie bei Schlaefenlappentumor). *Acta med. Scand.*, 1937, 93: 330.

The relative lack of local symptoms in tumors in the temporal lobes seems to cause the great interest in the frequently associated defects in the visual field. This disturbance in the visual field usually develops rapidly, possibly after a previous stage of achromatopsia and later amblyopia, before the absolute scotoma manifests itself. In a few cases the complete homonymous hemianopsia appears, but the more or less quadrantic form of defect in the visual field with a distinct predominance in the upper quadrants is more common. The quadrant defects of the two sides are often incongruent with more extensive loss of vision corresponding to the side of the lesion. Macular vision is often unaffected. The pupillary reactions are usually given as normal and the hemianopic as uncertain, but usually the latter are absent in most of the cases of partial hemianopsia. After operation, and possibly after relief from pressure, there is not rarely immediate restitution of the visual field.

With the described characteristic symptoms of quadrantanopsia in temporal lobe tumor the thought of some pressure effect comes to mind. Various authors have localized this pressure in very different parts of the visual tract. It has been shown that the different parts of the retina are projected in a regular manner to every part of the visual tract up into the cortex in the occipital lobe. This has been confirmed experimentally. In a cross section of the optic tract, the upper median part is infiltrated by fibers from the upper retinal quadrant, the lower part by those of the lower quadrant, and the region between these by the macular bundle with its greatest distribution in the lateral part of the tract. In the lateral geniculate body the various fiber bundles are still more differentiated and more collected. Here, especially in the posterior parts, crossed and uncrossed fibers also lie close together. The further course of the fibers from the lateral geniculate body toward the cortex has played a predominant rôle in the discussion on visual field defects in temporal-lobe affections since it has been shown that the ventral bundle in the optic radiation at first, in an anterior direction, courses in the temporal lobes and there surrounds the lateral horn, before it turns backward toward the occipital lobe and the area striata.

Numerous operative and autopsy findings have shown that in advanced cases of temporal-lobe tumor the optic tract and the lateral geniculate body are often exposed to direct pressure effects. Most authors also see in this the cause of the homonymous visual-field defects, which in this stage usually approach complete hemianopsia. As to the genesis of the quadrantanopsia appearing in the earlier stage, of the type described above, the opinions vary. Most investigators, including Cushing, speak of a pressure effect upon Meyer's "temporal loop," possibly even with its destruction. This explanation seems likely, especially in regard to its agreement with the previously mentioned observation, that the defect is usually localized in the upper visual-field quadrants.

The cause of the homonymous quadrantanopsia in temporal-lobe tumor is still unsettled. The majority of authors believe that the expansive pressure exerted by the tumor plays a decisive part, but opinions differ as to its localization in the visual tract. The most popular hypothesis, that this pressure affects the visual radiation, is not supported by clinical observations, and is contradicted by many. The occurrence of pressure directed against the optic tract by a closely adjacent temporal lobe, in the case of an expansive process there, has often been verified at operation or autopsy. In order to produce a quadrantanopsia, the pressure would have to localize itself selectively on the cross-section half of the optic tract. This is very unlikely, as the pressure localized upon a relatively large surface would have to produce a like tension of all the fibers in the cross section. Hirsch's observation, that the central visual tract, namely the optic chiasm, is particularly resistant to such pressure, also denies the possibility of this selective pressure effect.

In order to show that local nutritional disturbances may also play an important rôle in this problem, the author describes the vascular supply of the optic tract and the lateral geniculate body. From the internal carotid artery, the anterior chorioid artery passes posteriorly. This small, but constant artery lies close to the underside of the optic tract and follows it to the lateral geniculate body. This vessel in its passage gives off branches to the optic tract and to nearby parts of the base of the brain and pons, and its terminal branches course to the chorioid plexus and the lateral geniculate body. Every

nucleus has a special blood supply, and of such a type that the anterior chorioid artery supplies the lateral parts of the lateral geniculate body and the posterior chorioid artery supplies the median and lateral parts. An intermediate zone between these vessels shows a relatively better perfusion and receives two branches from the two mentioned arterial stems, but chiefly from the posterior chorioid artery. It is thus shown that the anterior chorioid artery in the greater part of its course is wedged between the optic tract and the temporal lobe. Pressure exerted by the latter affects particularly this vessel, and because of the relative firm consistency of the tract, compression of the artery might easily result. The resulting local ischemia in the lateral part of the lateral geniculate body must result in a homonymous, bilateral, upper quadrantanopsia, of the usual type found in temporal-lobe tumor. It is very difficult to present evidence for the correctness of this theory, but a few cases from the literature confirm it. Several authors have found, in most of the cases of quadrantanopsia of the type described, signs of a general vascular injury, often lues or arteriosclerosis. Occasionally the defect is limited to chromatopsia. Absolute hemianopsia has often been observed to follow hemi-achromatopsia in cases of brain tumor. Achromatopsia often disappears after decompression. In hemianopsia of the transitory type restitution has been observed to follow the passage of a stage of hemi-amblyopia with subsequent hemi-achromatopsia.

The views presented on the genesis of quadrantanopsia in temporal-lobe tumor possibly explain some additional peculiarities. The macular bundle is not or only insignificantly affected by a compression of the anterior chorioid artery, and, therefore, central vision remains intact. The localization of the injury in the lateral geniculate body also explains the occurrence of incongruent visual-field defects and the not rare persistence of the pupillary reflex. Several authors mention pyramidal-tract symptoms in temporal-lobe tumor, such as facial paralysis and paresis in one or both contralateral extremities. As the pons receives a part of its blood supply from the anterior chorioid artery, an explanation of this symptom also seems possible. LOUIS NEUWELT, M.D.

CORRECTION

Cohen, H.: Glossopharyngeal Neuralgia. *J. Laryngol. & Otol.*, 1937, 52: 527.

The terms *primary* and *secondary* with reference to glossopharyngeal neuralgia were unfortunately transposed in an abstract which was published February, 1938, p. 120.

The primary neuralgias occur in the absence of any demonstrable pathology and are characterized by (1) short paroxysmal attacks of pain, (2) "trigger zones", (3) absence of clinical evidence of nerve loss, (4) recurring intervals of pain over many years without spread to neighboring nerves, and (5) onset in middle or old age.

The secondary neuralgias are associated with a gross pathological lesion involving the nerve, e.g., tumor, inflammation and hemorrhage. They are characterized clinically by (1) constant boring pain with exacerbations, (2) objective evidence of nerve involvement, (3) associated progressive involvement of neighboring structures, and (4) occurrence in any age group.

SYMPATHETIC NERVES

Grimson, K. S., Wilson, H., and Phemister, D. B.: The Early and Remote Effects of Total and Partial Paravertebral Sympathectomy on Blood Pressure. *Ann. Surg.*, 1937, 106: 801.

As an addition to the current interest in surgical treatment of hypertension, the authors report the early and late effects of complete and partial removal of the paravertebral sympathetic chains, or of partial anterior spinal rhizotomy, on the blood pressure, blood volume, blood viscosity, cardiac output, and pulse rate of dogs. The article is adequately illustrated by charts, graphs, and tables of results.

It was found that following sympathectomy there was a fall in the blood pressure which, however, had returned to pre-operative levels by the end of six months, and that a bradycardia and a decreased cardiac output occurred concurrently with the drop in the blood pressure. The authors believe that the peripheral vascular resistance during the stage of lowered blood pressure is due to an inherent vascular tone, but that after the blood pressure has returned to normal it is due in a large measure to reëstablished central vasomotor tone. Judging by the response of the sciatic nerve to stimulation, recovery of vasoconstriction is eventually incomplete. Upon electrical stimulation of the sciatic nerve, hypothalamus, and the distal cut end of the spinal cord early in the period following complete sympathectomy, the authors found that the fall in blood pressure in their animals suggested the presence of extrasympathetic vasodilator pathways in the brain, spinal cord, and somatic nerves.

JOHN MARTIN, M.D.

LOBECTOMY AND PNEUMONECTOMY

A Collective Review from January, 1936, to July, 1937

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THE past year and a half have been a significant period in the development of lobectomy and pneumonectomy. This period has followed immediately on those recent years when it was demonstrated that resection of the lung was not only possible in the human, but was applicable in a much broader sense than was considered possible heretofore.

Monod and Bonniot (31) have divided historically the evolution of pneumonectomy into three stages (the same stages of development might also be applied to lobectomy): (1) the experimental stage, from 1881 to 1900, beginning with the demonstration of Gluck that the removal of an entire lung could be tolerated in the experimental animal; (2) the stage of preparation, from 1900 to 1918, during which time the obstacles of open pneumothorax were overcome, and (3) from 1918 to the present, during which time there has been a realization of accomplishment of the operation in man. The beginning of the third period, that of accomplishment, probably should not be dated quite so far ahead as the work of Brunn (7) in 1929 and Shenstone (46) in 1932 actually launched lobectomy in the thoracic clinic. The period of accomplishment in pneumonectomy came even later. According to Mason, (27) Kummel performed the operation in man and other attempts were made by Meyer, Lilienthal, and Archibald. The first successful total removal of the lung by Nissen was not done until 1931. The past one and a half years have, therefore, followed closely upon the origins of these operations and mark the beginning of the period of elaboration and standardization.

LOBECTOMY

The subject matter of the majority of recent publications on lobectomy has been concerned primarily with the report of successful operations performed for bronchiectasis, with a discussion of variations in the surgical technique. A total of 63 cases have been reported. Individual case reports from foreign clinics have been made by Monod (29), Coryn and Clerens (10) (France), Pieri (38) (Italy), Roberts (43) (England), and Kirschner (22) (Germany). In this country Head (19) and Harrington (18) have published case reports. O'Brien (33) and Churchill (9) have reported a series of cases and have discussed their experiences to date.

The history of lobectomy is replete with variations in technique and divergences of opinion regarding fundamental points. In the recent reports, however, one finds a surprising unanimity of opinion concerning the treatment of the pedicle of the pulmonary lobe. The use of a tourniquet, excision of the lobe immediately following ligation, suturing of the stump with multiple ligatures, and closed drainage by means of a catheter have been carried out by all operators in much the same way. All, with one exception, prefer to make a clean cut removal of the involved lobe once the circulation to that lobe has been shut off. Nissen (32) described a multiple stage technique in which there is delayed strangulation of the involved lobe. At the first stage the hilum of the lobe in question is encircled by a rubber tube, which is later to act as a tourniquet. On subsequent occasions, approximately ten, twenty-one, and twenty-eight days later, the tube is tightened to shut off gradually the circulation to the lobe. In the case reported the necrotic lobe was finally removed on the thirty-fourth day. Nissen believes that such a delayed ligation is safer than the strangulation method of Alexander, as the sloughing of the lobe occurs in the presence of adhesions.

Recent reports on lobectomy carry on the controversy concerning the one-stage and the two-stage operations. The surgeons in Great Britain have adhered consistently to the one-stage procedure, and there is a definite tendency in this country toward more extensive use of the single operation. Even though all are willing to admit that the one-stage operation is the ideal procedure, there are some surgeons in this country and in France and Germany who maintain that a two-stage operation can be carried out in a case in which the pleura is free and will always be safer than the one-stage procedure. All authors with the exception of three, however, have used the one-stage operation and essentially the technique of Brunn and Shenstone. Forty-two of the total of 63 operations were done in one stage and only 1 death in each group was reported. These figures in no way represent the operative mortality in

cases of lobectomy during this period inasmuch as most reports were of individual successes without comprehensive reports of the experience of each author. Only two papers giving a report of a complete series of cases have appeared during the period in question, one by Churchill (9), the other by O'Brien (33). Churchill reported 19 one-stage operations with no deaths and 19 completed two-stage operations with 1 death. O'Brien reported 1 death in a series of 15 operations done in one stage.

Churchill has taken the position that there are places for both the one-stage and the two-stage procedures; his indications are given in Table 1. Two considerations have been brought up by Churchill (9), which may have been factors in the excellent results he has obtained. He advocates a closed season for lobectomy in cases of bronchiectasis to correspond with the cycles of respiratory infections in the community. In general he prefers not to operate from the middle of December until the first of May. Churchill also felt it advantageous to delay for a period of six weeks or more between stages if a two-stage operation had been decided upon. The delay between stages permits the patient to receive the benefits of an improved general condition so that he faces the hazardous step of the surgical program in a better condition than ordinary methods of pre-operative care can bring about. The improvement is thought to be due to a release of firm adhesions binding the affected lobe to the costophrenic sulcus, and to the temporary compression and collapse of the lobe by residual pneumothorax and pleural effusion.

Monod (29) has presented an excellent critique of the advantages and disadvantages of the two-stage lobectomy when the pleura is free. The following features are considered objectionable to the two-stage operation: (1) there is a double operative risk; (2) the dissection is more difficult; (3) treatment of the pedicle is less precise; (4) the resection of the lobe is incomplete, and (5) bronchial fistulas are longer in closing. Because of these difficulties Monod favored the one-stage operation in the dry hemorrhagic type of bronchiectasis and when the lesion was small, and in all cases in which the pleura was adherent. The important objections to the one-stage procedure in the presence of a free pleura are considered by Monod to be: (1) a greater likelihood of immediate cardiopulmonary mechanical changes, (2) infection of the pleura, mediastinum, or other pulmonary lobes, and (3) tension pneumothorax. Monod maintained that the possibility of serious consequences from infection in the event of a free pleura is too great to justify routine use of the one-stage procedure. He, therefore, preferred a two-stage operation in the majority of cases of suppuration of the lung if the disease had not been associated with a previous pleurisy. He mobilized the involved lobe, covered it with gauze, and permitted the end of the gauze to project through the wound which had been closed so as to be air tight. Three weeks later the wound was reopened, and the lobe amputated after application of a tourniquet and mass ligatures.

In Germany, two-stage procedures are favored. The technique of Nissen has been commented on. Sauerbruch (45) has advocated the use of a preliminary extrapleural paraffin pack to incite the formation of adhesions. The lobe is excised at the time of the second operation. Sauerbruch advised a subtotal resection in order to have tissue with which to cover the stump. Nissen has abandoned the preliminary extrapleural paraffin procedure since he has observed that this method has at times failed to produce the desired symphysis of the pleural surfaces. Kirschner (22) believes it is important to suture the drainage tube to the bronchial stump in order to insure adequate drainage when the sutures in the bronchus are absorbed and the bronchial fistula forms. He considered that such a method, for all intents and purposes, carries the bronchial stump beyond the pleural cavity, and avoids the complications of a large bronchopleural fistula.

Minor modifications of the Brunn-Shenstone technique have been suggested. O'Brien used three Pezzer catheters instead of a single catheter to facilitate drainage and re-expansion of the remaining lobe during the early postoperative period. Harrington, in preparation for lobectomy in a case of bronchiectasis, carried out a preliminary paralysis of the phrenic nerve and preliminary pneumothorax. Pieri found that peridural

TABLE I.

One-stage Operation
Obliterated pleural space or strong adhesions binding upper lobe to chest wall
Children
Middle lobe resections
Severe hemoptysis
Lobar atelectasis particularly if upper lobe does not show emphysema
Draining thoracotomy sinus or bronchocutaneous fistula
Cutting into infected lung when freeing adhesions
Bronchial stenosis
Two-stage Operation
Adults with free pleura
Febrile patients with active pneumonitis
Patients treated for a prolonged period with artificial pneumothorax and not having an adherent upper lobe
Bilateral cases with free pleural space

anesthesia as described by Dogliotti was satisfactory from the standpoint of quiet respiratory action during the operative procedure.

LOBECTOMY IN BILATERAL BRONCHIECTASIS

Recent reports indicate less hesitancy in embarking on a program of surgical treatment in cases of bilateral bronchiectasis. Lewis (23), Churchill (9), and Overholt (35) have reported successful bilateral operations, and added 6 cases to the only other case, that of Eloesser, reported before this time. Overholt pointed out that it is just as logical to consider the removal of two or three lobes from different sides as to remove the same number of lobes from one side, as in pneumonectomy. In the case which Overholt reported three lobes were removed, the right, the middle and lower, and the left lower. In this patient the two upper lobes practically filled the entire chest, as the involved lobes were completely atelectatic. The upper lobes were therefore responsible for all respiratory function before the diseased lobes were excised. No physiological or anatomical alteration in respiratory function followed. Overholt suggested that in cases of bilateral disease without atelectasis of the involved lobes a two-stage operation be considered on the grounds that the first stage produces a shrinkage of the involved lobe. There is a gradual expansion of the remaining lobe and thus the remaining lung is prepared for the added burden before the excision is finally accomplished.

LOBECTOMY FOR LUNG ABSCESS

Once a pulmonary lobe has been destroyed by disease the primary excision of that lobe may prove to be the safest and shortest way out of the difficulty. There is a growing feeling that certain patients with an abscess of the lung can be treated more satisfactorily by lobectomy than by thoracotomy or pneumonectomy by means of cautery. Monod (30) reported a successful case in which lobectomy was carried out after external drainage had failed to relieve the symptoms. Monod discussed the value of lobectomy in the treatment of abscess of the lung; he believes it is more beneficial from the standpoint of the sequelæ of such an infection than for the abscess itself. In cases of multiple cavitation or associated bronchiectasis lobectomy should be considered. For an uncomplicated lung abscess Monod believes that thoracotomy should precede lobectomy, yet he grants that lobectomy may in the future be used as a primary surgical procedure. Bohrer (3) reported a case in which lobectomy was done for a central abscess of the right lower lobe, in which there had been repeated massive pulmonary hemorrhages. A free pleura was found and a one-stage procedure was carried out.

Reports indicate, therefore, that there will be a much wider application of lobectomy as a primary form of treatment in lung abscess. The list of indications for consideration of lobectomy should include: (1) extensive multiple cavitations; (2) bronchiectasis; (3) hemorrhage; (4) a massive thick-walled single cavity in which more than one half of the lobe has been destroyed, and (5) older patients in whom malignancy cannot be ruled out.

LOBECTOMY FOR CARCINOMA

Recently there have been but 4 cases reported in which carcinoma of the lung was treated by lobectomy, a frequency no greater than that found in previous years. With a continued increase in the total number of lobectomies for other conditions and an increase in the number of operable tumors of the lung, it would seem that there has been a relative decrease in the use of lobectomy in the treatment of carcinoma.

Two of the 4 cases of lobectomy were reported by Jacobaeus (21); the operations were performed by Key. One patient died five weeks after operation and autopsy revealed metastasis to the mediastinum and brain. The second patient was living nine months after a right lower lobectomy was carried out, but was known to have metastasis to the pelvis. Rist, Monod and Jacquet (42) successfully performed a left lower lobectomy for peripheral epidermoid carcinoma in a patient sixty years of age. The patient was alive four months after operation without evidence of recurrence. Nissen (32) reported successful removal of the right upper lobe.

None of the 4 cases recently reported should be used in support of an opinion regarding the value of lobectomy in the treatment of primary carcinoma of the lung. In the first case reported by Jacobaeus metastasis was obviously present at the time of operation, and it was probably present in the second case as well. At the time the operation was done the resection of any amount of tissue by either lobectomy or pneumonectomy would not have cured the patient. In the other 2 cases reported, a sufficiently long follow-up report to permit practical conclusions was not made.

Two anatomical studies have been made recently which have far greater bearing upon the applicability of lobectomy in cases of primary carcinoma of the lung than the recent case reports. Bonniot, Monod and Evrard (5) dissected 200 lung specimens hardened in formalin. A minute description of the vessels, nerves, and

bronchi in the pulmonary pedicle is given. They found many variations in the number and the position of the branches of the vessels of the hilum, two of which are of practical importance. First, they found that certain branches of the artery to the lower lobe may originate above those to the middle lobe. Second, the arteries to the inferior lobe may produce a collateral circulation to one or two other lobes. They found no parallel between the branches of the artery, vein, or bronchus of either lung.

Bonniot and Dargent (4) carried out a very interesting study of the pulmonary pedicle in cadavers. Tourniquets were applied to the various lobes as practiced in the surgical clinic in performing lobectomy. The hilum was sectioned and the structures in the stump were studied. It was found that the tourniquet cord might injure (1) the pericardium, near the left pulmonary artery or inferior pulmonary vein; (2) the vena cava, vena azygos, esophagus, or vagus nerve, or (3) the vessels to the remaining lobes, especially when the tourniquet was applied to the upper lobe.

It also was found impossible to apply the tourniquet on the right upper or middle lobes close enough to include a tumor of the stem bronchus and at the same time not include part of the bronchus of the lower lobe. From these studies, it was concluded that carcinoma of the stem bronchus, especially that in the upper lobe bronchus, should not be treated by means of a tourniquet.

PNEUMONECTOMY

Pneumonectomy has been discussed to a greater extent in the literature during the past year and a half than in any previous period. As with lobectomy the greatest number of articles are concerned with the report of successful operations. It is of interest to note that during this period 19 operations have been reported, 15 (more than three-fourths) of which were done for conditions other than malignancy. In the early days of pneumonectomy the procedure was considered to be such a daring step that the majority of the operations were reserved for carcinoma. It is also interesting to note that only 2 operative deaths (13 per cent) were reported in the noncancerous and younger group of patients. In the 4 cases in which pneumonectomy was performed for malignancy, in patients of middle age or older, 2 operative deaths occurred.

Although the articles on anatomical and physiological alterations in the thorax after pneumonectomy has been performed are less in number, they contain detailed descriptions of technical procedures in man and are by far the most important contributions of the period.

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS

One of the early questions raised as a result of successful surgical removal of an entire lung was, "What is the future of the remaining lung?" Roentgenograms of the thorax and studies made at post-mortem examination have shown an increase in the size of the lung as well as a readjustment of the position of the thoracic viscera and thoracic walls. In two early articles dealing with the subject opposed views were presented. Hilber (20) in 1934 said that the increase in the size of the lung, at first the result of simple distention of the alveoli, was gradually altered by a true regeneration of normal lung tissue, accomplished by new growth. This entailed an increase in the number of the units containing new alveoli of normal size and structure and remodeling of the bronchial tree. The second view, presented by Rienhoff, Reichert, and Heuer (41) in 1935, was that there occurred a simple dilatation of the respiratory units, made up of the bronchiolus respiratorius, the ductus alveolaris, the atria, the sacculi alveolares, and the alveoli. They observed no evidence of true hyperplasia or hypertrophy.

Bremer (6) has found that both of these views are correct depending on the age of the individual. True regeneration may take place by means of new growth of normal alveoli and respiratory units, marked by the presence of tubular sprouts, which apparently are projections from the alveolar wall. The number of alveoli may be increased and the number of lobules increased without a change in the size of the individual units themselves. Regeneration occurs in the young, and dilatation in those whose lungs have ceased growing. Bremer also stated that in the rat and possibly other rodents in which normal growth continues throughout life, regeneration of lung tissue in adult forms might be expected. Bremer also pointed out that simple dilatation of the alveoli would give only a little more respiratory surface than in the original lung; the increase is due to the lengthening of the alveolar walls. The physiologically dilated lung might also be at a disadvantage in that the air would not be so finely divided and would thus lower the ratio of air surface to air bulk.

Rienhoff (39) has reported observations made at autopsy in 2 cases of congenital absence of one lung, in 2 cases of post-traumatic atrophy of one lung, and in patients who had died at variable periods of time after pneumonectomy had been

performed. He found compensatory dilatation of the alveoli but no fragillation of the elastic tissue surrounding the definitive respiratory unit. Rienhoff chose to term the change in the remaining lung "compensatory dilatation" and not "emphysema," which, he pointed out, is a pathological condition in which there is an interruption of the elastic tissue. He was not able to elicit any evidence that the compensatory dilatation which occurs in the remaining lung after pneumonectomy has been carried out was harmful either in man or animal.

Longacre, Carter, and Quill (24) carried out a series of comparative tests on dogs before and two months after left pneumonectomy had been performed. They attempted to determine the efficiency of the cardiorespiratory system by studying the physiological response to varied degrees of moderate strain. They found that in pneumonectomized animals, one, one and a half, and two months after operation, a sufficient cardiorespiratory reserve was present for resting conditions and for moderate exercise. Under varying amounts of strain, however, the animals showed proportionate embarrassment. In terms of ultimate strain on the cardiorespiratory unit by means of the anoxemia test, the critical level of oxygen for the normal animals before pneumonectomy was done revealed a clear cut end point of between 5 and 6 per cent oxygen. Two months after pneumonectomy had been carried out this value had risen to 11.3 per cent oxygen. Four months after operation the critical level was back to 9 per cent. Other tests run months after operation also showed less embarrassment, due to compensatory changes, as evidenced by (1) an increase in the tidal air, (2) an increase in the subtidal lung volume, and (3) increase in the hemoglobin.

These observations substantiate clinical observations in regard to the status of the pneumonectomized patient. Within six months or a year after operation such patients carry out the ordinary activities of life with perfect ease. With anything more than moderate exertion, however, the pulse and respiratory rates may be increased and the patient may become dyspneic.

TECHNICAL CONSIDERATIONS

Two recent publications (Rienhoff (40) and Overholt (36)) have dealt entirely with technical matters in performing pneumonectomy. Rienhoff alluded briefly to a pre-operative method of preparing the pleura by inducing a lining of granulation tissue to form on the pleural surfaces. It is not made clear in the article just how this is accomplished. Rienhoff used an anterior approach and found it helpful to carry out the dissection of the hilum by opening the mediastinal pleura and ligating the pulmonary artery in the superior mediastinum. The pulmonary veins were treated intrapleurally. The cartilaginous ring of the bronchus was clipped circumferentially. Ligation was accomplished by either an encircling ligature of silk or by means of interrupted silk sutures. In the dissection of the right pulmonary artery Rienhoff considered it best to approach the vessel from its posterior aspect as there was nothing between the posterior wall of the pulmonary artery and the primary bronchus but loose areolar and lymphoid tissue. Rienhoff employed tribromethanol in amylene hydrate, 80 mg. per kgm. of body weight, as a basal anesthetic and supplemented it with nitrous oxide. An intratracheal tube was not used.

Overholt (36) has described in detail the technique of performing pneumonectomy as employed in 11 cases. He is convinced that the period of preparation by producing pneumothorax (from three to six weeks) should be sufficient for complete readjustment of the remaining lung. Indications have been found for the use of either an anterior or a posterior approach and both were used with equal frequency. Admittedly the anterior approach is the shortest route and permits inspection and palpation of the anterior mediastinum before the lung itself is mobilized It was used in lesions of the stem bronchus when a free pleura had previously been demonstrated by pneumothorax. It was pointed out by Overholt that the posterolateral approach was advantageous when (1) the lung was infected and there was potential danger of pleural contamination, as in bronchiectasis and multiple abscesses, (2) when a rapid operation was required and when the tourniquet and mass treatment of the hilum was contemplated, and (3) when difficulties in mobilizing the lung were contemplated. The posterolateral incision provides a wide exposure of the hemithorax, permits a more rapid and precise mobilization of the lung to be carried out, and affords an approach to the hilum from all four directions, rather than a limited anterior and superior approach, as obtained with the anterior incision.

Three papers relating to technique have appeared in the foreign literature. O'Shaughnessy (34) carried on experiments for the purpose of throwing light on the causes of sudden death when the region of the lung root was being operated on. The work of Morrison was reviewed. He found that rabbits survived pneumonectomy

only if the vagus was divided in the neck as a preliminary procedure. O'Shaughnessy demonstrated a slowing of the pulse and a drop in the blood pressure if traction was made on the lung root. Electrical stimulation of the same region was followed occasionally by apnea and by an increase in the pulse rate. It was found that atropine failed to abolish the reflexes. Topical application and subpleural injections of solutions, such as percaine and novocain, abolished the respiratory reflexes, but the cardiovascular reflexes remained uncertain. It was concluded, however, that blocking of the vagus stem was no safeguard against reflex disturbances.

Dargent (11) made observations on the effect, both immediately and later, of pneumonectomy in rabbits and dogs. Little influence on the blood pressure was found. Traction on the vena cava near the auricular orifice produced extra systoles, and this region seemed to be the most sensitive region around the lung root. During the ligation of the bronchus no change in vital functions was noted. Dargent ingeniously measured the pressure of the pulmonary artery by cannulization of the left pulmonary artery as a preliminary step, closure of the thorax, then massive ligation of the right pulmonary pedicle. There was a transitory increase in the pulmonary pressure but for the most part the pressure remained constant. From Dargent's researches it was concluded that in the performance of pneumonectomy it was important to use preliminary pneumothorax, to employ positive-pressure anesthesia, to handle the tissues in the region of the hilum with extreme gentleness, and to ligate the arterial branches first. In observing the later effects Dargent reported changes in the remaining lung similar to those found by Rienhoff.

Defrise (13) recognized, as do all thoracic surgeons, that the three most important problems in performing pneumonectomy are anesthesia, bronchial closure, and the fate of the dead space in hemithorax. When pneumonectomy was performed experimentally Defrise used an automatic "spiropulsator" which permitted a rhythmical increase and decrease in the intrabronchial pressure during anesthesia. He considered the alternate insufflation under hyperpressure and practical standstill of the inflated lungs, the Meltzer-Auer procedure, to be undesirable. The bronchus should be sutured carefully transversely. Defrise advised that a window should be placed in the mediastinum to facilitate the extension of the contralateral lung into the dead space. This, he believed, decreased the pull on the mediastinum.

CASE REPORTS OF PNEUMONECTOMY

During the period in question 15 cases were reported in which pneumonectomy was carried out for non-carcinomatous pulmonary conditions, the majority being bronchiectasis (Table II). A basal anesthetic supplemented by the administration of nitrous oxide was the usual anesthesia. The hilum was treated with a tourniquet or clamp with mass ligation in all cases. Drainage was used also quite universally. Thirteen of the 15 patients (86 per cent) recovered.

Each author reported various modifications in technique. Arce (1, 2) packed the pleural cavity with gauze, the end of which was permitted to emerge from the wound. The gauze was removed on the fifteenth day. Mason (28) carried out a mass ligation and a delayed excision of the necrotic lobe, Alexander's lobectomy technique, in 3 cases. In 3 other patients the first stage consisted of a removal of the lower lobe and the second stage of removal of the upper lobe. Walker (47) severed the pedicle with a diathermy cutting current. Both Roberts (44) and Edwards (16) cut the phrenic nerve at the time of operation, and the latter used a streptococcic vaccine pre-operatively.

Reports of 4 cases in which pneumonectomy was done for malignant conditions have appeared during this period. Undoubtedly there are many other cases, the reports of which are being prepared. Lyle (25) successfully removed the right lung of a patient sixty-one years old for a lesion originating in the upper lobe. Unfortunately, enlarged and firm glands were found in the hilum. The patient lived five months. Flick and Gibbon (15) removed the left lung in a patient forty-five years old in whom evidence of an extension of the tumor to the mediastinal glands and pericardium was found. The patient lived two and a half years after operation. Arce (1) reported 2 cases in which pneumonectomy was carried out for carcinoma; the right lung was involved in both cases. He used cyclopropane anesthesia, a Wertheim clamp to control the pedicle, and gauze tamponade placed within the chest. One patient lived eight hours, the other forty-eight hours after operation.

The recent reports of 4 patients on whom operation was performed for carcinoma of the lung and in whom death occurred might be discouraging. The number is limited. In the 2 cases in which operation was carried out, metastatic involvement was present at the time of resection of the lung. Neither of these cases, therefore, can be used in an appraisal of the value of the operation. The relatively low mortality in the non-

TABLE II.—REPORTED CASES OF PNEUMONECTOMY, JANUARY, 1936, TO JULY, 1937

Author	Age, yrs.	Diagnosis	Side	Anesthesia	Number of stages	Treatment of hilum	Operative recovery	Late result	Remarks
Mason, G. A. (4) (28)	13	Bronchiectasis	Left	Avertin, nitrous oxide	2	Mass ligation	Yes	Living 18 months	Delayed excision of necrotic lung 11 to 30 days after ligation of pedicle
	18	Bronchiectasis	Right	Avertin, nitrous oxide	2	Mass ligation	Yes	Living 15 months	
	7	Bronchiectasis	Left	Avertin, nitrous oxide	2	Mass ligation	Died at second stage		
	10	Bronchiectasis	Left	Avertin, nitrous oxide	2	Mass ligation	Yes	Living 6 months	Separate one-stage resection of lower lobe, 2 months to 1 year later one-stage resection of upper lobe
	11	Bronchiectasis	Left	Avertin, nitrous oxide	2	Mass ligation	Died 14 hours after second operation		
	8	Bronchiectasis	Left	Avertin, nitrous oxide	2	Mass ligation	Yes	Living 2 months	
Edwards, T. (48)	7	Bronchiectasis	Left	Avertin, nitrous oxide	1	Tourniquet	Yes	Well	Pre-operative injections of autogenous streptococcal vaccine. Phrenic nerve interruption at operation
	10	Bronchiectasis	Right	Scopolamine, nitrous oxide	1	Tourniquet	Yes	In hospital	
Churchill, E. D. (9)	16	Bronchiectasis	Left	Avertin, nitrous oxide	1	Tourniquet	Yes	Well	Interrupted sutures in hilum without mass ligatures. Thoracoplasty 3 months later
	?	Bronchiectasis	?	?	2	?	Died		
Arce, J. (1) (2)	12	Polycystic disease	Right	Ethylene	1	Clamp. Mass ligation	Yes	Living 3 months	Packs pleural cavity with gauze after excision of lung
	?	Nodular tuberculosis	Right	?	1	Clamp. Mass ligation	Yes	?	
	?	Carcinoma	Right	Cyclopropane	2	Mass ligation	Died 8 hours		Double lobectomy of upper and middle lobes, then lower lobe removed
	?	Carcinoma	Right	Cyclopropane	2	Mass ligation	Died 48 hours		
Walker, R. M. (47)	7	Bronchiectasis	Left	Nitrous oxide	1	Tourniquet	Yes	Well 6 months	Lung amputated by diathermy
Burnett, W. E. (8)	8	Bronchiectasis	Left	Regional	1	Tourniquet	Yes	Well 3 months	No positive pressure used
Roberts, J. E. H. (44)	5	Bronchiectasis	Left	?	1	Tourniquet	Yes	Well	
Lyle, H. H. M. (25)	61	Carcinoma	Right	Colonic ether	1	Separate ligation	Yes	Died	Peripheral tumor with metastasis to hilar glands
Flick and Gibbon (15)	46	Carcinoma	Left	Avertin, nitrous oxide	1	Separate ligation	Yes	Died 8 months	Pericardial and mediastinal metastasis found at operation

carcinomatous group indicates definitely that extirpation of an entire lung is becoming a practical and feasible operation.

GENERAL CONSIDERATIONS OF CARCINOMA OF THE LUNG

Success in performing lobectomy and pneumonectomy has stimulated clinical interest in the early recognition of primary carcinoma of the lung. What was before a subject for discussion around the autopsy table now must concern all physicians who treat patients complaining of symptoms referable to the thorax. Graham (17), in the "Balfour Lecture" before the University of Toronto School of Medicine, regarded the lungs as one of the most common sites of origin of malignant lesions, such lesions occurring in the lungs in from 5 to 10 per cent. It was pointed out also that from 75 to 80 per cent of the patients were subjects for a positive diagnosis. Graham has been unable to find any incontrovertible evidence that any patient who has primary bronchial carcinoma has been cured by radiation therapy, and that operation, pneumonectomy in preference to lobectomy, offers the best chance for cure.

Overholt (37), in conclusions based on a study of 23 patients who had primary carcinoma of the lung, makes the statement that in all except 4 the lesion had originated in the stem bronchus. Examination of a specimen obtained at biopsy was positive in 15 of the 16 lesions of the stem bronchus so examined, which indicated a high incidence of clinical discovery. Overholt

maintained that several facts regarding primary carcinoma of the lung make early diagnosis possible in a fairly large proportion of cases if the condition is kept in mind; (1) a persistent cough, a warning symptom, appears early; (2) a large majority of the growths originate in a stem bronchus and therefore can be visualized, and (3) the lesion of the stem bronchus is limited by cartilaginous rings and apparently grows slowly for a period of months until the infiltrating process breaks through these bounds. Overholt also emphasized that in the stem-bronchus type the usual roentgenographic appearance was that of atelectasis of a lobe. It is unusual to see a definite shadow of the tumor itself. In early lesions in which the obstruction is incomplete there may be no roentgenological evidence of any disease. Reliance for early diagnosis rests solely, in those cases, upon a bronchoscopic examination.

The peripheral or pneumonic form of primary malignant lesions, originating in the smaller bronchi or bronchioles, produces a different picture because of its location and non-connection with the major bronchi. In this form of malignancy metastasis is more likely to have taken place before clinical diagnosis can be made. In the series studied by Overholt extensions of the tumor were found in the majority of cases and in those in which operation was performed, subsequent events revealed that metastasis had been present at the time of operation.

Dargent (12) in his monograph on the surgical treatment of bronchopulmonary carcinoma also has taken the position that the type in which prognosis is most favorable is the stem-bronchus variety, that lesion which is invisible bronchoscopically.

A symposium on lobectomy and pneumonectomy was held at the French Surgical Congress in 1936 (48). Monod of Paris and Bonniot of Grenoble reported an incidence of from 7 to 8 per cent of pulmonary carcinomas compared to carcinomas in other parts of the body and they believed that irradiation was valueless. Treatment should consist of pneumonectomy by multiple ligations of the components of the pedicle. The importance of early diagnosis was stressed. At the same congress Edwards of London reported the results in 7 cases in which pneumonectomy was performed for bronchiectasis; the mortality was 28 per cent. In 6 cases in which the patients were from thirty-one to sixty-three years of age, pneumonectomy was performed for carcinoma with 2 operative deaths, 1 metastasis, and 3 survivals. The cases of Edwards were not included in the summary of cases in this review since details were not included in the correspondents' report of the French Surgical Congress. Undoubtedly this entire series will appear in a separate publication.

ANESTHESIA

Anesthesia by inhalation, positive pressure, nitrous oxide, with or without basal narcosis (avertin) has been used more frequently than any other form. A number of departures from this type have been made. Lyle (25) used colonic ether, Pieri (38) used a peridural anesthesia, Lewis (23) used spinal anesthesia, and Burnett (8) recommended a local field block. Arce (1) preferred cyclopropane inhalation.

Magill (26) discussed anesthesia in thoracic surgery. He reported his experience with spinal anesthesia, with the use of percaine 1:1500, in 23 cases in which lobectomy or pneumonectomy was performed. Occasionally local infiltration was necessary for anesthesia of the upper limits of the incision. Magill found that patients were able to breathe well without the use of a mask and positive pressure, and rarely was it necessary to administer oxygen.

That nitrous-oxide-oxygen anesthesia in thoracic surgery may fall short of the ideal is admitted by Magill. He pointed out that nitrous-oxide-oxygen anesthesia implies at least some degree of suboxygenation and that alternate bouts of cyanosis and oxygen inflation are unlikely to enhance the prospects of cure in patients suffering from pulmonary disease. Magill stated that cyclopropane is a godsend in operations on the thorax and that the operator who is able to forego the advantages of diathermy in order that atraumatic anesthesia such as cyclopropane provides may be employed is amply repaid for his concession.

A general discussion of the anesthetic problems peculiar to thoracic surgery has been given by Eversole and Overholt (14). Attention was called to factors which reduce the lung volume and limit the absorption of anesthetic mixture. The poor tolerance of thoracic patients for anoxemic states and the great failing of most anesthetic mixtures to provide high concentrations of oxygen were pointed out. Cyclopropane does, however, permit the administration of 80 per cent or more of oxygen, and at the same time a depth of anesthesia is obtained which approaches that of ether. The dangers of anoxemia are thus overcome. It was concluded that when general anesthesia was desired, cyclopropane more nearly approached the ideal than any other anesthetic.

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SURGERY OF THE THORAX

CHEST WALL AND BREAST

McKittrick, L. S.: Interstitial Radiation of Cancer of the Breast. *Ann. Surg.*, 1937, 106: 631.

This report concerns the effect of interstitial radiation, with or without supplementary external radiation, upon cancer cells in a given breast, upon such cells in the lymph nodes within the reach of surgical dissection, and upon borderline and inoperable cases.

The author states that the term "operable cancer" is applied to breast tumors which are freely movable on the chest wall, with a sufficiently limited involvement of the skin to permit a wide removal of normal skin and closure of the resulting wound. Lymph nodes, if present, cannot be palpated above the lower part of the axilla, enlarged supraclavicular nodes are absent, and the cancer is not of the so-called inflammatory type.

In treating the patients included in this report, from six to twelve 2 mgm. needles and from twenty to forty 3 mgm. needles of radium sulphate were inserted. The total dosage varied from 13,000 to 25,000 mgm. hours. Two or three of the 2 mgm. needles were placed above the clavicle and in the infraclavicular area, a 3 mgm. needle was inserted over each intercostal space near the sternal margin and, usually, two or three needles were placed parallel to the opposite sternal edge. Finally, needles were introduced in relation to the tumor as follows:

The tumor was encircled by needles placed deep to it, avoiding, if possible, insertion of the needles into the tumor itself. Whenever it was possible to do so, a second layer of needles was inserted superficial to the growth and at right angles to the needles underneath. The needles were left in place seven days.

A slight erythema of the skin was usually present at the time of removal of the radium needles. This erythema increased for as long as two or three weeks after treatment, and not infrequently there was a loss of skin over the tumor-bearing area. The skin reaction was widespread. After from six to eight months the entire breast became edematous, firm, heavy, and inelastic. In several patients the breast became smaller. In either instance the resulting deformity was equal to that following amputation. The most disturbing and frequent after-effect of treatment was pain along the free margin of the pectoralis muscle, which was accompanied by a palpable thickening and partial limitation of abduction of the arm.

The diagnoses were made on a clinical basis, but the author states that in almost every instance the

diagnosis was sooner or later confirmed by a pathological section, or by the clinical course of the disease. Ten of the 96 patients later submitted to amputation of the breast. Complete primary regression of the tumor had occurred in 5 of the patients. In 2 of these 5, no cancer was found, a mistaken diagnosis having been made in 1 case in which the tumor was benign, and in 3, cancer was proved pathologically following operation.

There were 26 operable cases treated with radium. Fifteen (60 per cent) of the tumors suffered complete primary regression, 3 (12 per cent) diminished by 50 per cent, and only 8 (28 per cent) proved to be resistant to radiation. The author states that even though complete disappearance of the mass did take place, the presence of cancer in small foci throughout the breast was not excluded by the failure to find a mass.

The author believes that the results obtained in inoperable carcinoma of the breast depend upon the size of the local tumor almost as much as upon its radiosensitivity. He prefers preliminary external radiation if there is extensive ulceration, then interstitial radiation.

EARL O. LATIMER, M.D.

Cohn, L. C.: Carcinoma of the Female Breast, with Special Consideration of Pre-Operative Irradiation: A Preliminary Report. *Arch. Surg.*, 1937, 35: 694.

Cohn presents a preliminary report on the pre-operative irradiation of carcinoma of the female breast based on a five-year study. Of 43 patients who received pre-operative irradiation followed by a radical operation, 71 per cent were living and free from recurrence for an average of one year and ten months after the irradiation. Of 51 patients who had a radical operation without pre-operative irradiation only 33 per cent were living and free from recurrence, but the average length of time since the operation was considerably longer, three years and four months. Of a third group of 42 patients receiving irradiation followed by the excision of the tumor, only 31 per cent were living and free from recurrence for an average period of two years and three months.

No evidence was found that pre-operative irradiation was of value in early cases of cancer in which there was no involvement of the axillary glands, but in the group which showed metastases to the glands, 44 per cent of the patients receiving pre-operative irradiation were well as compared to 24 per cent of those who had the radical operation alone. However, the difference in the time that had elapsed must be considered.

The reason for making a preliminary report of this work was that sufficient time seemed to have elapsed to indicate that there was apparently no danger in delaying a complete operation for one course of pre-operative irradiation provided a period of time, about two and a half or three months, was allowed between the irradiation and the operation.

ELIZABETH M. CRANSTON

Devenish, E. A., and Jessop, W. H. G.: Swelling of the Upper Limb Following Radical Mastectomy. *Brit. J. Surg.*, 1937, 25: 261.

Radical mastectomy remains the method which gives the best results in treating operable carcinoma of the breast. It is therefore desirable to minimize the complications of the operation and such consequences as postoperative swelling, in the absence of recurrence of the carcinoma, on the upper limb on the affected side.

Postoperative, non-malignant swelling of the arm occurs in 1 of every 6 patients who have undergone radical mastectomy, and this swelling reaches a size sufficient to cause some trouble to the patient in more than one-third of the cases. It renders the limb heavy and fatiguing to use, causes disfigurement, necessitates the wearing of special sleeves in the patient's garments, and produces undue susceptibility to inflammation.

Marked shrinkage of the limb follows continuous elevation or suspension. Recurrence of the swelling is prevented by a light, thin rubber corset fitted to give uniform pressure to the entire limb.

J. DANIEL WILLEMS, M.D.

TRACHEA, LUNGS, AND PLEURA

Iselin, M.: Extrafascial Apicolysis—Semb's Operation (L'apicolyse extra-fasciale—méthode de Semb). *Presse méd.*, Par., 1937, 45: 1539.

Iselin reviews the principles and technique of the operation of extrafascial apicolysis as developed by Semb. The differences between the classical apicolysis of Tuffier with its endofascial separation and the extrafascial operation of Semb are shown, and emphasis is placed on the advantages of the latter procedure. The advantages are particularly marked in those cases in which, because of extensive pleuritis, the endothoracic fascia has become fused with the parietal pleura and no cleavage plane can be found between them. It is in these cases especially that an adequate collapse is most needed. By completely freeing the lung with its coverings from the fixed points about is upper borders, the Semb operation allows the lung to collapse along all axes toward the hilum. The lung is maintained in this collapsed condition by the regeneration of the ribs over its surface. This optimum collapse can be obtained by the resection of fewer ribs than were resected by any of the older types of thoracoplasty.

The results obtained with extrafascial apicolysis by Holst, Semb, and Frimann-Dahl, and by Overholt are quoted. In 1935 the former group reported on the late results in 105 patients and found that 77 had been rendered free from tubercle bacilli. The total mortality for the 138 patients operated upon was 7 per cent. It was only 3 per cent when fewer than six ribs were resected, 12 per cent when eight ribs were resected, and 19 per cent when a total thoracoplasty was done. In this latter group of 21 patients all but 6 operations were done in one stage. Overholt in his series of 106 cases never resected more than four ribs at any one time and reported a

mortality of 5.6 per cent. Twenty-eight per cent of his patients had bilateral cavitation. Before using the Semb operation he obtained satisfactory collapse in 71 per cent of 133 patients; since he has used it the figure has risen to 92 per cent of 98 patients.

Iselin does not give his own results with the operation, as he considers them to be too recent to be of value. He expresses his enthusiasm for the Semb operation and emphasizes its particular importance in those cases in which a marked peripleuritis makes the extrafascial apicolysis difficult, for in these cases effective collapse could not otherwise be obtained. Instead of the usual type of incision he has for more than a year been using a muscle-splitting incision for the posterior approach. At the time of the first-stage operation he makes an anterior approach through two incisions, one axillary, the other subclavicular. All of the first rib and part of the second rib are resected, and the entire convexity of the pleural dome is freed from above and in front. At the second-stage operation three weeks later a muscle-splitting posterior incision, based on the incision described by Picot of Lausanne, is used, and the next four, five, or six ribs are resected. Also at this time he carries out an extrafascial separation of the posterior surface of the lung, the posterosuperior angle, and the mediastinal aspect. He limits the extent of the first stage to the resection of four ribs and apicolysis. He has had excellent results, and the types of incisions used have decreased the amount of deformity and disability.

RICHARD H. MEADE, JR., M.D.

Semb, C.: Thoracoplasty with Extrafascial Apicolysis. *Brit. M. J.*, 1937, 2: 650.

Semb believes that thoracoplasty should be concerned primarily with the closure of cavities. This closure should be obtained with the minimum interference with normal lung tissue and should carry an operative mortality of 3 per cent or less. This conservation of the maximum amount of normal lung tissue makes possible the application of collapse therapy to bilateral cases. Knowledge of the low operative mortality will help to prevent patients from postponing operation to too late a period, or from refusing it altogether.

A study of 177 cases chosen for thoracoplasty showed that in 90 per cent the cavities were confined to the upper lobes. In 84 per cent of a series of 102 unselected cases, the posterior part of the lungs was found to be the location of the cavities. Thoracoplasty is thus concerned mainly with the upper and posterior parts of the lungs.

The most perfect type of pulmonary collapse is obtained by means of artificial pneumothorax in the absence of adhesions. This concentric relaxation is not obtained by the ordinary methods of thoracoplasty. The addition of extrapleural apicolysis improves the collapse, but does not produce a permanently effective one. However, the use of extrafascial apicolysis in conjunction with radical selective thoracoplasty gives a permanent and effective collapse. In this procedure, the division of the suspension bands of the lung allows concentric collapse of the mobilized lung. The periosteum of the resected ribs is allowed to remain attached to this surface, though separated from its attachments to the vertebral column and the sternum. Later, regeneration of the ribs will maintain the lung in its new position.

Local block anesthesia with 0.5 per cent novocaine and .05 per cent pantocaine is used by Semb in performing his operations. He finds that this allows quiet respiration, preserves the cough reflex, and decreases hemorrhage. In apprehensive patients, small doses of evipan or pentothal are given intravenously.

The division of the operation into stages and the resection of from only 2 to 5 ribs at a time is important. The apicolysis is done at either the first or second stage, the condition of the patient being the deciding factor. The extent of rib resection is regulated by the position of the cavity and the mobility of the underlying lung. A close relationship between the extent of the operation and the postoperative reaction has been observed. Between the period from 1932 to 1937, 246 patients were operated upon in one or more stages. The mortality was 6 per cent within two months, and 5 per cent later. From 1934 to 1937, 149 patients were operated upon in several small stages, with a drop in mortality to 3 per cent within two months, and 3 per cent later. Pulmonary complications occurred less frequently when small operations were done. When 3 or 4 ribs were resected, and an apicolysis was done, there were pulmonary complications in less than 5 per cent of the cases. When more ribs were resected at one stage, the figures mounted to 9, 25, and 61 per cent, the percentage of complications depending on the number of ribs that were resected.

Phrenic paralysis should not be used prior to thoracoplasty as it handicaps normal lung tissue and increases the risk of pulmonary complications after thoracoplasty. It may be of value after thoracoplasty in completing collapse of the diseased lung.

Extrapleural pneumolysis with plombage is more dangerous and less effective than thoracoplasty with extrafascial apicolysis. It should not be used before a thoracoplasty, as the fibrotic reaction about the paraffin interferes with mobilization of the lung.

In patients who have had an ineffective pneumothorax, it is important to allow the lung to re-expand before thoracoplasty is started, as its presence needlessly cuts down on the respiratory surface and makes the danger of empyema more likely.

In the prevention of wound infections, Semb now excises the intercostal muscles over the mobilized lung, as their devitalization by interruption of their blood supply encourages infection. Drainage is not used unless there is much oozing and then only for twelve to twenty-four hours.

Of 246 patients who were operated upon in the period from 1932 to 1937, 219 survived. Of these

living patients, 90 per cent had complete closure of their cavities and 86 per cent had their sputum rendered free from tubercle bacilli. In the last three years, 93 per cent of 149 patients have had their cavities closed and 91 per cent have had their sputum freed from tubercle bacilli. It was necessary to resect more than 8 ribs in only 10 per cent of the patients. Among 17 patients with contralateral pneumothorax, there were no deaths; 14 of these had their cavities closed and their sputum freed of tubercle bacilli. Sixteen patients who had been unsuccessfully subjected to ordinary thoracoplasty were re-operated upon by the new method, with success in 14. RICHARD H. MEADE, JR., M.D.

Laffitte, H.: Intrapulmonary Teratoid Embryoma. Removal in One Stage (Embryome tératoïde intra-pulmonaire. Exérèse en un temps). *Mém. l'Acad. de chir.*, Par., 1937, 63: 1076.

Laffitte notes that while intrathoracic tumors are rare, they are being recognized considerably more frequently with the modern methods of roentgenological study.

The patient in the author's case was a woman twenty-one years of age who had slight pain in the thorax five years before admission to the hospital. Two years later she began to cough, and had an occasional slight hemoptysis; hairs were found in the sputum. Before admission to the hospital the patient had shown considerable loss of weight. The roentgenogram showed a round opaque area with regular borders in the upper lobe of the left lung. After the injection of lipiodol, it was found that the opaque medium passed around the tumor. At operation the electric knife was used for section of the lung; there was no difficulty in enucleating the tumor as it was surrounded by sebaceous, fatty matter and was easily separated from the surrounding tissue. The patient's recovery was complicated by a pleuropulmonary pneumococcus infection, but she was discharged from the hospital in good condition. After she was discharged she rapidly gained in weight and had no symptoms except a slight morning cough.

The tumor which was removed was a solid growth of ovoid, irregular shape. Its outer surface was a

Fig. 1. Photograph of the teratoid embryoma.

thick skin with brownish well-formed hairs of varying length, "glued" together by a sebaceous material. The interior of the tumor was made up of pale yellow tissue with numerous cysts and a harder nucleus in the center. Histologically, the external layer of the tumor was epidermis. The tumor contained many different types of tissue, representing various organs; the cysts were lined with ciliated cylindrical epithelium of the pharyngeal type. The glandular formations included the salivary, the thyroid, and the thymus types. Muscular fibers interspersed with cylindrical mucous glands were of the intestinal type. The tumor also showed glands of the type of the islands of Langerhans in the pancreas, cartilage, and nerve fibers of the sympathetic type. It was therefore a teratoid embryoma.

ALICE M. MEYERS.

REGIONAL ILEITIS

A Review of the Literature and a Case Report

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THE study of regional ileitis is fascinating. The disease has excited more wonderment and interest than any other surgical condition during the past few years. It seems incredible that this condition was not recognized as a specific entity until Crohn, Ginzburg and Oppenheimer (23) so beautifully described it in their classical monograph. The disease must have existed for centuries. One is reminded of the fact that medical science itself made a belated appearance all down through history in comparison with other arts and sciences. The sciences of physics, chemistry, and astronomy were well understood when medicine was still in its crude beginning. Nike of Samothrace (Winged Victory), Venus de Milo, and the Laocoön, sculpture that has never been excelled, were produced a century or two before Christ. Homer wrote his Odyssey at a time when diseases were treated by superstitious rites or by the giving of horrid concoctions. Chaucer wrote the Canterbury Tales two centuries before the ligature was applied to an artery to control hemorrhage. Rembrandt had painted his great picture, The Anatomy Lesson, two hundred years before Pasteur linked bacteria with disease, and Michelangelo was spreading his canvases with infinite beauty long before this. It was late in the nineteenth century that Lister began applying the principles which Pasteur taught and thereby developed antiseptic surgery. Accurate knowledge of anatomy was not attained until the 13th or 14th century. Appendicitis was not recognized except as inflammation of the bowels until comparatively recent times.

HISTORY AND CHRONOLOGY

The literature, prior to 1932, does make reference to a heterogenous group of cases under various terms, such as benign granuloma of the intestines, infective granuloma, various cancers and tumors in the abdomen, and non-specific granuloma of the intestine. The concept of early writers of regional ileitis was that of a tumor-like mass, characterized by the piling-up of granulomatous tissue and exhibiting varying stages of necrosis, fibroblastic changes, and scar tissue. While many writers recognized these masses as non-specific tumors, much confusion was apparent in their classification. This error found its basis in the similarity to other tumor masses due to tuberculosis, syphilis, actinomycosis, Hodgkin's disease, and lymphosarcoma. The very word itself, granulomas, applied indiscriminately to all lesions, gives evidence of this confusion. Most pathologists contend that the suffix, oma, always refers to a true tumor. The only distinction which differentiates these masses from true tumors noted by some of the early and modern writers is that they were called infective granulomas. This, of course, conveys the idea of an inflammatory tumor-like mass.

Mock (68) says, "The literature of our own country has dealt inadequately with these inflammatory granulomatous masses as a definite entity." The word has been used very loosely. He states that one of the first clinical reports of this condition dealing with the subject as a definite entity was made by Braun (12) in 1909. Prior to this, and even until 1923, all cases were usually regarded as instances of hyperplastic tuberculosis of the intestine or other specific tumor masses. One of the first reviews of benign granulomas was made by Tietze (88) in 1920. In 1923, Moschcowitz and Wilensky (69) contributed to the literature under the title of "Non-Specific Granulomata of the Intestine," and stated that the recognition of this condition thus far seemed confined to European observers and, even then, the literature covered only the last decade.

It was Mock's splendid article, "Infective Granuloma," in 1931, which revived interest in this unusual condition. He recognized that these tumor-like masses were due to low-grade inflammatory causes. He did not include in this group those specific granulomas, such as gumma, tuberculosis, actinomycosis, blastomycosis, and anthrax. In other words, he preceded Crohn in the recognition that they were a non-specific type of lesion, sharply differentiated from specific or true granulomas.

A personal reference might be illuminating. A young medical student, twenty-three years old, presented a tumor-like mass within the abdomen, the size of a large grapefruit. He was thin, anemic, and in poor health. Moderate indigestion, loss of

appetite, and pain were the paramount features. At operation, a large tumor-like mass was felt and seen in the retroperitoneum. It was semi-hard and fixed and entirely inoperable. No section was taken as this was deemed inadvisable and dangerous. The abdomen was closed with a diagnosis of sarcoma. To make a long story very short, this tumor was entirely absent within a period of from two to three months. The young man regained his health and is now continuing his course in medicine. This unquestionably represented a granulomatous tumor of low-grade inflammatory type, probably originating in the retroperitoneal lymph glands. It represented a type of tumor which Mock describes.

It is to be said, however, that Mock's description did not embrace the definite concepts which we now have from Crohn. His concept of the pathology was that the hyperplasias were usually sterile and that the underlying cause of their formation was some local interference of the blood supply resulting in a small area of necrosis; this in turn was followed by reparative tissue reaction. Such granulomas revealed microscopically a mass of chronic granulation tissue with fibroblastic and lymphoid tissue surrounding areas of necrosis. Giant cells were occasionally seen. Many of these tumors, therefore, had easily been taken for carcinoma because of large groups of lymphoid cells, while in other cases the small round cells so predominated that the picture appeared to be that of sarcoma.

Mock enumerates the following causes and examples: (1) conditions existing within the gastro-intestinal tract itself or its mesentery, such as sigmoid diverticulitis, a hyperplastic mass developing at the site of a gastric ulcer (usually following a small perforation), polypi of the intestines, and foreign bodies within the intestines; (2) extra-peritoneal infections which gradually spread to and involve the gastro-intestinal tract, such as a low-grade infection in the retroperitoneal lymph glands and the chronic inflammatory changes seen in a constricted omental hernia; and (3) trauma from surgical accidents or extraneous injuries such as (a) ligatures or sutures which constrict and act as a local interference to the blood supply, or sutures which act as a foreign body; (b) foreign material, such as sponges and instruments which are left in the abdominal cavity; and (c) trauma in general, such as undiagnosed mesenteric lacerations or rupture of the intestine.

Considerable space has been devoted to a review of this splendid article by Mock for the reason that he, for the first time, sharply differentiates true granulomas represented by tuberculosis, and syphilis, from these infective lesions which simulate them. Some of the confusion was swept away. However, he and previous writers did not recognize the definite pathological or clinical entity which the term terminal or regional ileitis embraces.

There seems to be no doubt that Crohn and his associates with their astute observations and logical deductions finally swept away all remaining confusion regarding the classification of these similar conditions.

For the sake of summary then, it might be well to epitomize them. There are three types of granulomatous tumor-like masses which seem to fall into distinct and separate classes:

1. Those that occur in association with that class of specific diseases, namely, tuberculosis, syphilis, actinomycosis, Hodgkin's disease, and lymphosarcoma.

2. Those occurring with other conditions as described by Mock under the term of infective granulomas.

3. Those occurring with true regional, or terminal ileitis, a definite pathological and clinical entity.

Fate decreed that Crohn, Ginzburg, and Oppenheimer, in 1932, were to be given credit for the first accurate description and recognition of regional ileitis. This description was based on a report of 14 cases. So complete and meticulous was their description of this disease; so accurate were their observations; so logical their deductions, that the article stands as a masterpiece in medical literature. Very little has been added by subsequent writers to their original concepts of the disease. These additions will be referred to later. The article stimulated tremendous enthusiasm and interest in surgeons, internists, roentgenologists, pathologists, and research students. Many splendid papers have appeared since then and many more cases have been reported. The conclusion is inevitable that this disease must have gone unrecognized. It hardly seems possible that it can be new.

In this connection, I have just read an article under the caption, "Acute Abdominal Catastrophes" by Irvin Abell (1). Hyman I. Goldstein, Camden, New Jersey, in his discussion of the paper states, "On July 4, 1806, before the Royal College of Physicians, of London, Charles Combe and William Saunders reported a typically fatal case of terminal ileitis with 2 to 3 feet of the intestine involved, under the title, 'A Singular Case of Stricture and Thickening of the Ileum.' John Abercrombie (1780–1844) reported a case in a girl,

aged thirteen, with about 18 in. of the lower end of the ileum involved. If we are to use an eponym for this clinical entity, let it be 'Saunders-Abercrombie-Crohn's disease'."

These cases have not been reviewed. The quotation is presented for what it is worth for completion of the argument. It is the opinion of the writer, however, that these reports should in no way replace the credit for the first description of this disease as a special entity by Crohn and his associates. These authors coined the name, "terminal ileitis" and stated that the process involved the terminal ileum for a distance of from 20 to 30 cm. Subsequent reports indicated that it could be more extensive. They stated that the process stopped abruptly at the ileocecal valve and did not involve the cecum. The following year, however, Harris, Bell, and Brunn (53) questioned the limitation of the disease to the terminal ileum. One of their cases showed the identical lesion involving the jejunum. It was their belief that with more universal recognition of this disease process by surgeons, other cases involving the jejunum as well as the terminal ileum would be reported. They, therefore, suggested the name, "chronic cicatrizing enteritis." They believed that any part of the small intestine might be involved.

Brown, Bargen, and Weber (13) in 1934, basing a report on 18 cases, stated that the lesion may occur in any part of the small intestine. In 4 of their cases, it involved the cecum and the terminal ileum. In 1 case it involved one section of the jejunum.

Following this report, Colp (17) reported a case in which the disease extended beyond the ileocecal valve into the cecum. He stated that the ileocecal valve did not arbitrarily limit the progress of the disease to the ileum. Following these manuscripts in which the writers noted that the disease attacked other portions of the bowel, Crohn and Rosenak (24) in 1936 presented another report embracing an experience of 60 cases which were observed and operatively confirmed, and enlarged their original pathological concepts to include a simultaneous inflammatory and ulcerative colitis. Of these 60 cases, 9 cases presented involvement of the colon. Crohn had been loath to accept the statement that this disease process could involve the colon because the original 14 cases all showed identical topographical involvement. Furthermore, it had been observed that when a short-circuit operation was done the disease in the ileum never extended into the anastomosed colon. He called attention to an interesting observation in this connection, to wit, that ulcerative colitis is capable of involving the ileum by backwash. Colitis and ileitis of this type, however, in no way resemble the hyperplastic granulomatous conditions of terminal ileitis.

On the other hand, the regional ileitis which has spread into the colon is essentially that ileitis which must be considered as the dominant factor and as contributing to the main clinical features. "The differentiation from primary ulcerative colitis is made on the basis of the lesser severity of the colonic involvement, the very mild degree of diarrhea in spite of high temperature and the presence of the predominating symptoms of ileitis; namely, the mass in the right ileac region, abdominal cramps and eventually ileac stenosis."

ETIOLOGY

Almost without exception, all writers regard the cause of regional ileitis as obscure. No evidence of tuberculosis, syphilis, actinomycosis, or lymphosarcoma has ever been found. Inoculation of laboratory animals has always proved negative for tubercuoisis. Homans and Hass (55) injected macerated tissue from lymph nodes and serosa of the ileum into animals. They also made cultures under aerobic and partially anaerobic conditions. The animals all remained healthy and ten weeks after the injection the tissues were examined and no pathological lesions were disclosed. All cultures showed no growth.

Wassermann reactions are negative. All observers seem unanimous in their opinion that the appendix has no part in the cause of this disease although it is frequently removed prior to the recognition of the true condition.

Reichert and Mathes (78) suggested a possible causative factor. They injected irritating and sclerosing materials into the mesenteric and subseral lymphatics which led to a chronic lymphedema of the intestinal wall. They believe that the two dominant features are a low-grade infection with a concomitant chronic lymphedema. Felsen (34) disagrees with the accepted pathogenesis of the disease. He believes that chronic non-specific ulcerative colitis and regional ileitis, either alone or as associated lesions, are manifestations of bacillary dysentery. He states that it has been his privilege to describe 38 consecutive cases of chronic ulcerative colitis, 11 of chronic distal ileitis, 11 of acute distal ileitis, and 2 of nonspecific granuloma traceable to bacillary dysentery. On the other hand, Crohn states that he has never had a positive culture for bacillary dysentery.

The general consensus of opinion is that the process must be considered bacterial in origin.

PATHOLOGY

The disease most frequently involves the terminal ileum. It may, however, involve any portion of the small intestine and the colon. Pathological conditions vary according to the stage of the disease. It is thought that it begins as small oval ulcers along the mesenteric attachment of the ileum. Harris, Bell, and Brunn (53) state that it must be remembered that few observations are available in the very early cases. Many of these have been mistaken for appendicitis and the appendix has been removed without disturbing the coexisting ileitis. As the process progresses, the typical findings are those of a greatly enlarged, soggy, purplish, blotchy red, edematous bowel. The bowel itself is heavy, the mesentery is thick and stiff and contains enlarged glands. As the disease progresses the lumen of the bowel becomes irregular, distorted, and narrowed. The mucosa is subject to destructive ulcerative processes and edema, which often gives to it a bulbous or cobblestone appearance. The ileocecal valve is frequently converted into a rigid diaphragm with a small opening. Fistulous tracts, due to small perforations into contiguous structures, may result and in late stages are a constant and characteristic feature of the disease. The diseased bowel becomes adherent to contiguous structures and in order of their frequency, fistulous tracts occur in (1) the sigmoid, (2) coils of the ileum, (3) the cecum, (4) the ascending colon, (5) the hepatic flexure, and (6) the abdominal wall.

The tactile impression of this diseased bowel is strange and significant. One gets the impression of a heavy-bodied snake as he lifts it in his hands. It does not have the consistency of a soft lead pipe as has been suggested by other writers. It is more flexible than this, more elastic, and softer. There is nothing particularly significant in the microscopic anatomy. Marked inflammatory hyperplastic exudative, necrotic, and reparative changes are noted. These may take the form of acute, sub-acute, or chronic inflammation. Giant cells are commonly found. These are probably accidental due to the reaction against foreign material. The finding of these giant cells frequently leads to a diagnosis of tuberculosis.

CLINICAL FEATURES

The disease predominately attacks young male adults. Rosenblate, et al (80) reports 1 case in a boy four and one-half years old. Mixter (67) reports his oldest patient as being fifty-six years old, and states a high incidence among Hebrews. Statistics from the Mayo Clinic (91) reveal that their youngest patient was nine years old and their oldest sixty-two.

The acute form of the disease runs parallel in its manifestations to that of acute appendicitis, and is often indistinguishable from the latter. Typically, the disease is usually chronic in character and is characterized by loss of weight, progressive anemia, fever, attacks of diarrhea, and abdominal pain. Diarrhea is not as marked or severe as in cases of colitis, neither is there as much mucous or blood. Rectal tenesmus, perianal fistulas, and abscesses are absent. No case has been reported in which the disease involved the left colon or rectum.

As the disease progresses, there may be the usual signs and symptoms of obstruction due to stenosis of the involved bowel. Fistulous tracts also may be present. Many writers have called attention to the fact that an appendix scar is usually present.

In chronic stages of the disease, a mass is palpable at the site of the lesion, usually in the right iliac fossa. It is, of course, evident that the clinical signs and features of the disease will vary according to the stage and to the involvement of contiguous structures. It should be emphasized, however, that this disease is characterized by certain fundamental signs and symptoms; namely, progressive weakness and loss of weight, cramplike pain in the lower abdomen or right iliac fossa, diarrhea with some blood and mucus in the stools, fever, a mass in the right iliac fossa, and oftentimes evidence of fistulous tracts.

Crohn in his original article directed attention to the fact that there were four stages in the clinical course:

1. Acute intra-abdominal disease with peritoneal irritation. It is impossible to differentiate this stage from that of acute appendicitis or certain other acute inflammatory diseases in this region. This is probably the reason why the appendix has been removed so frequently and the real condition overlooked. The clinical signs and symptoms are almost identical with those of acute appendicitis. The appendix usually shows evidence of disease, but this disease is due to the spreading of contiguous inflammation and not due to a primary disease of the organ itself. One could liken this to the involvement of the appendix in acute, right adnexal inflammatory conditions. The appendix is thickened, the serosa swollen and red. The experienced operator frequently recognizes that this is a secondary involvement and, not being satisfied with the appendix as the original cause of the disease, explores the adnexa and there finds the primary

source. This picture is quite typical and distinct from that of appendicitis when the disease originates within the appendix itself.

2. Symptoms of ulcerative enteritis.

3. In the stenotic phase the symptoms are those of acute or subacute intestinal obstruction with inflammatory signs.

4. Persistent fistulas.

These four stages have been so beautifully described by many writers that it seems superfluous to enlarge further upon their manifestations.

Following is presented an epitome of symptoms and percentages as reported by Jellen (58) in a review of 50 cases.

	Per cent
Abdominal pain	72
Loss of weight	60
Palpable mass	58
Diarrhea	52
Anemia	42
Fever	38
Fistula	36
Vomiting	28

Attention of the reader is directed to the abstract on regional ileitis by Semansky, appearing in the University of Minnesota Hospitals (91). This splendid article embraces all the available knowledge and facts regarding the disease. A more beautiful word picture of this condition scarcely seems possible.

DIFFERENTIAL DIAGNOSIS

Inasmuch as the disease usually involves the right iliac fossa, the differential diagnosis is narrowed to other lesions which may give signs and symptoms of a similar nature in this region. Probably the most important differentiation is that of non-specific ulcerative colitis. One must remember that colitis generally can be diagnosed with the sigmoidoscope and the barium enema, and from its clinical features. There are, however, other types which involve only the proximal colon. These instances are few and relatively uncommon, and usually can be diagnosed with the barium enema. Other conditions are ileocecal and mesenteric tuberculosis, fibroplastic appendicitis or typhlitis, lymphosarcoma and Hodgkin's disease, actinomycosis, and carcinoma. These conditions are mentioned without further comment since the scope of this paper does not embrace the discussion of the salient features of each condition.

X-RAY FINDINGS

The value of the x-ray in diagnosis is pertinent and should be emphasized. Kantor (61) states that the barium enema usually gives negative results except in those cases in which the cecum is involved, when there are evidences of deformity of this organ. There may also be an occasional case in which the barium enema regurgitates into the deformed stenotic ileum. The most constant and positive results are obtained with the barium meal. At examination the roentgen findings, according to Kantor are as follows:

The first roentgen sign in regional ileitis affects the colon and ileum. The changes in the colon, however, unless the colon itself is involved, are likely to be reflex in nature. Important changes found in the ileum are: (1) a filling defect just proximal to the cecum, (2) abnormality in contour of the last filled loop of the ileum, (3) dilatation of ileac loops just proximal to the lesion, and (4) a "string sign," representing the actual lesion. The string sign, though characteristic, is not pathognomonic of ileitis. It may be present in other stenosing processes in this region. When present, however, the diagnosis of terminal ileitis must be given consideration. Weber has recently offered the term "twisted cord" appearance.

To these findings, Jellen (58) adds the following: constant non-visualization of the involved segment in some cases, and deformity of the cecum. Stierlin's sign is almost always present in the combined form of ileitis and colitis. Because of the similiarity of gross pathology of this lesion and ileocecal tuberculosis, this sign is present in both conditions.

TREATMENT

Meyer (65) and others state that occasionally the condition may resolve and a spontaneous cure result. Medical treatment is of little or no avail. Felsen (34) seems to be the only author whose work has been reviewed, who disagrees with this statement. He says that surgical treatment is unsatisfactory and that there is a high incidence of recurrence. The ideal therapy, according to him, is based upon the prevention of bacillary dysentery. With this exception there is a unanimous agreement that the treatment of regional ileitis is surgical and demands for its cure a wide resection of diseased parts. Recurrences after surgery, are due, according to Crohn and Rosenak (24) to the leaving of infected areas. "There are skip areas of ileitis in ileitis, and areas of healthy tissue between islands of diseased tissue."

The surgical treatment must be governed by the progress of the disease and the condition of the patient, but all surgical treatment is directed toward the extirpation of the diseased portion. If the condition of the patient is satisfactory, the

Fig. 1. Serosal surface of pathological specimen from case reported.

Fig. 2. Cut sections of pathological specimen from case reported.

operation may be performed at one sitting; that is, an ileocolostomy and an extirpation of the diseased segment.

Meyer and Rosi (65) state that a short-circuit operation without resection of the mass completely relieved the symptoms in about 50 per cent of the patients upon whom it was performed. They do not state the subsequent history of these patients, but they do go on to state that in their other cases in which this short-circuit operation alone was performed, the disease seemed to progress and required later resection. Holm (54) definitely showed, both operatively and clinically, that this side-tracking operation alone was a constant menace to the health of the patient. Berg (7), who has had a very wide experience, advocates resection with ileocolostomy as the operation of choice.

It is apparent, therefore, that the side-tracking operation alone is insufficient for a cure. Most surgeons have learned that operations requiring resection of the bowel should be carried out in multiple stages. This bitter lesson has been learned by trial and error, which has involved many failures and tragedies. Multiple operations of this type are parallel in their greater safety to the graded operations of radical prostatectomy. Many patients who present perilous conditions have been saved by this pattern of attack.

Pemberton (73) recently reported 39 cases of resection of the colon with only 2 deaths. Ileocolostomy was performed at the first stage. He also presented 43 cases of this preliminary operation with only 2 deaths. Mortality in skillful hands should not be high in spite of the early reports by some writers whose mortality reaches 36 per cent. Some surgeons have used the Mikulicz technique in their multiple stage operations instead of primary ileocolostomy. These procedures depend entirely upon the condition existing at the time of operation and the judgment and skill of the operator.

To epitomize then, medical treatment results in failure, although occasionally spontaneous cures may result. Short-circuit operations alone usually result in failure and are a menace to the patient who requires subsequent operations when he is less able to undergo them. Radical extirpation of the diseased portion in single or multiple stages is the treatment of choice.

REPORT OF A CASE

The author desires to report a case which has considerable human interest and also embraces all the typical and characteristic features of the disease. The human features refer to the errors in judgment on the part of the operator, not only once, but twice.

A young man, aged twenty-six, presented himself. His chief complaints were those of weakness, loss of weight, intermittent abdominal cramp-like pain, fever, and intermittent diarrhea with occasional blood and mucus in the stools. Examination revealed tenderness in the right iliac fossa and a suspicious mass. The leucocytes were about 15,000 and the polys 80 odd per cent. There was mild fever. A diagnosis was made of a possible appendiceal abscess.

Fig. 3. Regional ileitis. (B. S. Putts and Ralph Bacon, roentgenologists.)

Fig. 4. Regional ileitis. (B. S. Putts and Ralph Bacon, roentgenologists.)

Operation was performed through a right rectus incision. The ileum was found to be enlarged, edematous, thickened, heavy, purplish in color, and semi-flexible like the body of a snake, for a distance of 12 in. The disease ended abruptly at the ileocecal valve and tapered off gradually at the proximal end. The appendix itself presented almost the same appearance. The tip was attached at the ileum about 3 in. from the ileocecal valve. This condition was new and confusing to the operator, although he stated to the intern that in the back of his mind there was a mental picture of a condition described by somebody previously. The appendix was removed. The tip had become canalized to the ileum itself. Because this was so, it was an easy step of false logic to believe that somehow this canalizing of the appendix had caused the disease in the ileum. The appendix was removed and one more scar was added to the list of almost pathognomonic signs of terminal ileitis. Strangely enough, following the operation, the condition of the patient improved; he gained weight, the pain subsided, and his other symptoms were in abeyance. A few weeks later he returned, complaining of a recurrence of all the symptoms. At this time an x-ray study was instituted and the typical findings of terminal ileitis with stenosis were found.

Failure of human judgment occurred again, for in response to a request to wait until after the holidays for his operation, the writer acquiesced. Within twenty-four hours, an acute abdominal catastrophe was manifested by all the signs and symptoms of a perforation. Operation was hastily performed. The cecum at this time was involved. In spite of the fact that perforation of the ileum was present with local peritonitis, a radical resection of the terminal ileum and cecum was performed. The two ends of the bowels were brought out of the wound according to the Mikulicz technique. The convalescence was stormy, but because of the inherent resistance of the patient and providential favor, recovery resulted. Later a repair was made of the open ends of the bowel. This dramatic incident happened two years ago. The patient is alive and well.

Appended are pictures of the pathological specimens made after the latter had stood in hardening solution for two years. There are also the x-ray pictures. These seem to portray an accurate example of regional ileitis. Microscopic sections were made by H. H. Bullard, pathologist of St. Vincent's Hospital, whose diagnosis was terminal ileitis. He noted a few giant cells in some of the sections.

Following is a bibliography extending from 1932 through September, 1937. It includes all the references in the indices under the heading of: inflammatory lesions of the ileum, non-specific granulomas and terminal and regional ileitis. Two splendid additional reviews by Jackson and Pemberton, subsequent to this, are included. Other articles previous to 1932 have also been included. These are those of Braun, Tietze, Moschcowitz, Wilensky and Mock (1909, 1920, 1923, 1931). There is also appended a list of reported cases. These number 445, and, together with the author's case, make a total number of 446.

The author desires to give credit to other writers for material quoted, whether specified or not, and to Miss Márgueriete Prime and the Department of Literary Research of the American College of Surgeons, for the preparation of the bibliography and list of reported cases.

REPORTED CASES OF REGIONAL ENTERITIS

Year	Reported by	No. of cases
1932	Crohn, B. B., Ginzburg, L., and Oppenheimer, G. D.	14*
	Friedenwald: (See Crohn et al: discussion)	2
	Golob, M.	1
	Hirschman (See Crohn et al: discussion)	1
1933	Clute, H. M.	2
	Clute, H. M. (See Homans and Hass: discussion)	2
	Eggers, C. (See Gordon: discussion)	2
	Erdmann, J. F., and Burt, C. V.	5
	Fischer, A. W., and Luermann	3
	Gordon, D.	1
	Hanford, J. M. (See Gordon: discussion)	1
	Harris, F. I., Bell, H. G., and Brunn, H.	3
	Homans, J., and Hass, G. M.	2
	Jannsen, C. L. (See Gordon: discussion)	1
	Konjetzny (See Fischer, A. W., and Luermann: discussion)	2
	Molesworth, H. W. L.	1
	Peterson, E. W. (See Gordon: discussion)	1
	Plenk (See Fischer, A. W., and Luermann: discussion)	1
	Rockey, E. W.	4
	Simon, L. (See Fischer, A. W., and Luermann)	1
1934	Anschutz, G.	12
	Bell, H. G.	1
	Bissell, A. D.	2
	Breyer, J. H. (See Bell: discussion)	1
	Brown, P.W., Bargen, J. A., and Weber, H.M. (See Pemberton and Brown, 1937)	18*
	Colp, R.	1
	Corr, P., and Boeck, W. C.	1
	Crohn, B. B. (See later report)	30 to 40*
	Culbertson, C.	1
	Cushway, B. C.	2
	DeCourcy, J. L.	1
	Donchess, J. C., and Warren, S.	1
	Finney, C. M.	1
	Goldfarb, S. L.	2
	Haberer, H. von	3
	Holman (See Bell: discussion)	1
	Jackman, W. A.	2
	Kantor, J. L.	6
	Kapel, O.	2
	Ladd. (See Kantor: discussion)	2
	Peters, O.	3
	Phillips, K. T.	1
	Roepke, W.	1
	Schapiro, I. S.	1
	Smith, R. (See Bell: discussion)	1
	Stout, F., Hoagensen, and Smith	1
	Williams, C.	1
1935	Arnheim, E. E.	1
	Bargen, J. A., and Coffey, R. J.	4*
	Bargen, J. A., and Dixon, C. F.	2*
	Binney, H.	2
	Bockus, H. L., and Lee, W. E.	1
	Brunn, H. (See Mixter: discussion)	3
	Cabot	1
	Deelman, H. T.	4
	Delannoy, E.	2
	Erb, I. H., and Farmer, A. W.	4
	Erdmann, J. F., and Burt, C. V.	5
	Gagliardi, P.	1
	Galambos, A., and Mittelmann, W.	2
	Goetsch, E. (See Mixter: discussion)	1
	Groen, J., and Pompen, A. W. M.	6
	Jones, T. E., and Byrne, R. V.	4
	Lee, W. E. (See Mixter: discussion)	1
	Mixter, C. G.	11
	Semansky, E. J.	1
	Shramek, J. M., and Russum, B. C.	4
	Straaten, T.	3
1936	Barbour, R. F., and Stokes, A. B.	1
	Cabot	1
	Connell, F. G.	3
	Corriden, T. F.	1
	Crohn, B. B.	68
	Crohn, B. B., and Rosenak, B. D.	60*
	Downing, W. L., and Allen, C. V.	1
	Felsen, J.	51**
	Fenster, E.	4
	Friedl-Meyer, M.	1
	Gisbertz, H.	3
	Kate, J. ten	2
	Knapper, C.	2
	Koster, H., Kasman, L. P., and Sheinfeld, W.	17
	Meyer, K. A., and Rosi, P. A.	8
	Mulsow, F. W.	1
	Musick, V. H.	1
	Powers, J. H.	3
	Probstein, J. G., and Gruenfeld, G. E.	3
	Reichert, F. L., and Mathes, M. E. (Also Holman *1)	2
	Rosenblate, A. J., Goldsmith, A. A., and Strauss, A. A.	1
	Ross, K.	1
	Sanders, C. B.	5
	Schwabacher, H.	1
	Snapper, I., Pompen, A. W. M., and Groen, J.	6
	Sproull, J.	1
	Taylor, J. L.	2
1937	Adams, H. D.	15
	Bisgard, J. D., and Henske, J. A.	1
	Colbeck, J. C., Hurst, A. F., and Lintott, G. A. M.	2
	Forbes, R. D., and Duncan, J.	5
	Goldsmith, R. (See Ravdin and Rhoads: discussion)	1
	Halligan, E. J., and Halligan, H. J.	1
	Hodgson, J. C.	1

Jackman, W. A.	2
Jackson, A. S.	4
" (Western Surgical Society Members)	64
Jellen, J. (Mt. Sinai)	50*
Johnston, R. C.	2
Kallius, H. U.	1
Kinsella, V. J.	1
Knapper, C.	2*
Kropveld, S. M.	3
Landois, F.	1
Larimore, J. W.	2
Leonardo, R. A.	1
Merke, F.	3
Olson, O. A.	1
Pemberton, J. J., and Brown, P. W.	39
Pemberton, J. J., and Whittaker, L. D.*	
Ravdin, I. S., and Rhoads, J. E.	6
Ryan, T. J.	1
Shearer, J. P., and Jackson, J. T.	1
Storey, W. E.	1
Veltman, A.	1
Vokoun, F. J. (including case of Tancik)	2
Lick, M.	1
Total number of cases	446

*Cases have been included in other reports listed herein.
**If we add Felsen's 51 cases the total becomes....497

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SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Nuttall, H. C. W.: Rectus Transplantation for Midline Incisional Hernias. *Brit. J. Surg.*, 1937, 25: 344.

It is a common experience that a lasting cure of incisional hernia is difficult to obtain. Because of frequent recurrences following operations, a considerable number of modified operative procedures have been advocated by various surgeons. Nuttall remarks that it is difficult to know which to admire most, the ingenuity of the surgeons or the fortitude of the patients. Many so-called radical cures have not been based on sound surgical or anatomical principles.

The author has devised a method of surgical repair for large primary or recurrent midline incisional hernias which has given excellent results in several cases. It consists essentially in detaching the abdominal rectus muscles from their insertion at the symphysis pubis, freeing the muscles from the rectus sheaths, and again attaching them in an overlapping manner to the fibrous tissues at the symphysis pubis.

THE OPERATION

With the patient on the table in the Trendelenberg position, a vertical incision is made and the skin and fat are dissected on both sides sufficiently to expose the lower halves of the recti and their sheaths. Any adherent peritoneum must be separated from the skin and the sac must be freed. Adherent omentum or bowel is freed and dropped back into the abdomen, and the hernial sac is closed by suture. Next the rectus sheath is carefully reflected from the muscle on both sides well down onto the pubis. Each rectus muscle is now detached from the attachment to the symphysis pubis without interfering with its nerve supply in any manner. Both of the rectus muscles are now stretched downward to the opposite side and firmly sutured to the ligaments and fibrous tissue at the pubis. If necessary, the muscles can be shortened by turning up the lower inch or so and suturing it in place. A series of additional sutures are next inserted along the edges to maintain apposition of the overlapped muscles. The rectus sheaths on either side are then brought together as well as possible; some deficiency does not impair the final result. Finally, the skin incision is sutured and a rubber dam drain is inserted. Abdominal exercises are regarded as important by the writer and are begun from ten days to two weeks postoperatively. At first the patient tenses the abdominal muscles by raising his head; gradually the effort is increased, and finally he attempts to sit up with the arms raised with no aid from the elbows. Later the extended legs are raised on the abdomen. The patient is advised not to wear a belt.

CASE REPORTS

The first case was that of a widow of sixty-eight years. She had undergone three operations elsewhere: in 1917, a midline subumbilical incision for uterine prolapse and in 1922 and 1927, for incisional hernia. On admission her general condition was good. A very large incisional hernia overhung the vulva; it was irreducible. Then was an orifice in the abdominal wall just above the pubis which admitted four fingers. Operation was performed on April 30, 1937. The rectus muscles were transplanted. On July 10, 1937, the wound was well healed, the muscles were firm, and there was no sign of hernia.

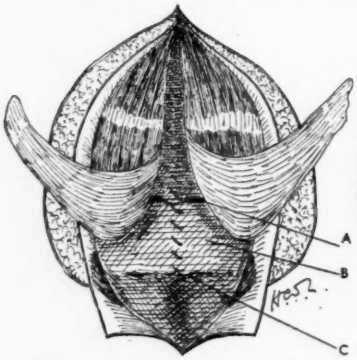

Fig. 1. Recti detached from pubis. A, Fold of Douglas; B, Transversalis fascia and peritoneum; C, Upper edge of symphysis pubis.

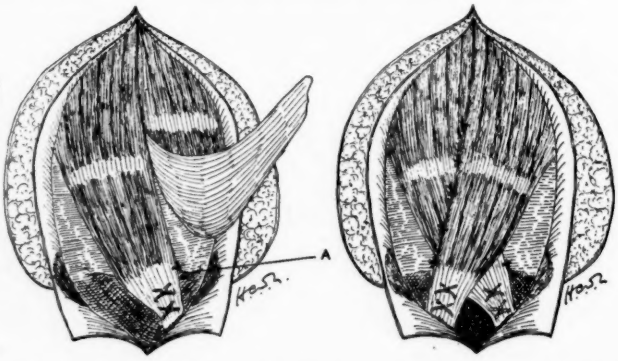

Fig. 2. Right rectus sutured to opposite side of pubis. A, Upper edge of symphysis pubis.

Fig. 3. Left rectus overlapping right and sutured to opposite side of pubis.

The second patient was a woman forty years of age. Cesarean section in 1930 had been followed by a midline incisional hernia. Examination revealed a fairly large hernia above the pubis, biloculated and irreducible. Transplantation of the lower ends of the rectus muscles was done on April 30, 1937. The upper portion of the rectus sheath was deficient and could not be approximated. On July 8, 1937, the wound was found to be healed, the muscles showed firm contraction, and there were no signs of hernia.

DISCUSSION

In selecting patients for this type of operation, the hernial orifice must be at or near the midline, usually just above the pubis. The tone of the muscles should be good. Diastasis of the rectus muscles is no contra-indication for the operation. Two of the patients operated upon by the writer had been previously regarded as hopelessly inoperable. The idea of utilizing living active muscle in the repair of abdominal hernias is not new. There is agreement on the principles of muscle transplantation on at least five points: the nerve supply must be preserved intact; the line of action from origin to insertion must be as straight as possible; the muscles should be sutured in moderate tension; muscles should be transplanted into bone if possible; and there must be no lateral pull on the belly of the muscle.

The question of what happens on the outer side of the rectus muscle when it is detached and brought across the midline may be answered by the fact that no lateral hernia develops because the sheath of the muscle remains intact on both sides and retains its connection with the flat muscles. After the muscles have been sutured in position, the sheath is drawn over the muscle again, which pulls the flat abdominal muscles toward the midline and effectively guards the areas to the outer side of the rectus muscles. It is remarkable how solid the lower abdominal wall feels when the muscles are contracted.

JOHN W. NUZUM, M.D.

GASTRO-INTESTINAL TRACT

Tangari, C.: Linitis Plastica and Hypergenesis of Connective Tissue in Fibrous Carcinomas of the Stomach (Linite plastica ed ipergenesi connettivale nei cancri fibrosi dello stomaco). *Clin. chir.*, 1937, 13: 579.

On the basis of extensive histological studies, Tangari found that in the general evolution of a carcinomatous process the original histological picture of the tumor undergoes a series of modifications which depend partly upon the local reaction of the stroma, and partly upon a sclerogenous diathesis of the individual which, in turn, depends upon endocrine factors. Examples of such histological modifications are found in scirrhous carcinomas of the breast and in linitis plastica, which represents classically the sclerotic evolution of a primarily carcinomatous process.

Histologically, linitis plastica is characterized by a more or less diffuse thickening of the gastric wall with its mucosa remaining intact. In other cases the lesion involves also the intestinal tract and gives rise to metastases in the mesenterial lymph glands, and sometimes it involves also the peritoneal serosa.

In order to interpret the histogenetic process of this fibrous hypergenesis correctly, the author studied histologically all the localizations of linitis plastica and compared them with the common forms of scirrhous carcinoma of the stomach and with other forms of epithelial tumors involving the gastric mucosa.

In ordinary cases of linitis plastica the carcinomatous process begins in the depths of the glandular tubules. The most superficial layer is not attacked and therefore the mucosa appears to remain intact for a shorter or longer period of time. There follows a rapid and general invasion of the entire gastric wall while an intense proliferation of fibrous tissue occurs around the individual neoplastic elements which are disseminated in the various layers. Dissemination occurs mainly by way of the lymphatics and the proliferation of the connective tissue has therefore a perilymphatic distribution.

At first the various layers may be identified, but as the process continues, the tissue assumes an altered and uniform or homogeneous aspect. This is shown microscopically by a dense fibrous mass containing here and there small epithelial nests distributed essentially endolymphatically.

In this general fibrous metamorphosis, the tunica muscularis deserves special attention in that the fibrocellular elements are, as the result of involutive modifications, finally confused morphologically with common fibroblasts, which may participate in the general fibrotic reaction.

The blood vessels of the invaded area also do not escape the general process. Microscopically they present hyaline changes, hyperplasia of the intima, and proliferation of the endothelial elements. The adenoid tissue of the regional and mesenteric lymph glands is replaced by a sclerotic stroma in which there are a few irregularly disseminated epithelial islands.

In the peritoneal serosa, the subserosa is greatly thickened. Microscopically it is seen to be sclerotic, callous retroperitonitis, and it contains small epithelial islands.

Tangari thus concludes that in general, microscopically as well as grossly anatomically, linitis plastica is analogous to the common forms of scirrhous carcinoma of the stomach, as well as with the entire group of specific inflammatory lesions involving the gastric wall. It is necessary, therefore, to differentiate linitis plastica of carcinomatous origin from all diffuse sclerotic conditions of the stomach due to inflammatory changes and specific infections. This differentiation is not always easy in view of the forementioned anatomicopathological resemblances.

RICHARD E. SOMMA, M.D.

Cardillo, F.: Sarcoma of the Stomach (Sul sarcoma dello stomaco). *Radiol. med.*, 1937, 24: 723.

Cardillo briefly reviews the clinical and anatomicopathological pictures of sarcoma of the stomach. He reports 4 cases which came under his personal observation. The youngest patient was twenty-eight years of age and the oldest was fifty-eight. In 3 cases the sarcoma was primary in the stomach. Two of these cases were round-cell sarcomas and one was a lymphosarcoma. The fourth case was a metastatic sarcoma with polymorphous cells, the site of the primary tumor being unknown. All 4 cases were controlled histologically. In 3 cases the correct diagnosis was made on the live patient. In the case with the metastatic lesions the diagnosis of sarcoma of the stomach presented no difficulties because there had been other manifestations of the disease before it was diagnosed with x-rays.

The lymphosarcoma was diagnosed roentgenologically.

In 1 of the cases the condition was at first confused with an atypical carcinoma and in the other case the presence of a diffuse vegetating mass led the author to suspect a sarcomatous lesion. On the basis of these experiences, the author discusses the possibility of diagnosing sarcomas of the stomach with the aid of roentgenology.

The author states that although there do not exist well defined roentgenological criteria for the differentiation of sarcoma from malignant epithelial tumors of the stomach, several attempts have been made to make this differentiation possible. The roentgenological differential diagnosis is somewhat easier in neoplasms with endogastric or exogastric development in the presence of a vegetating mass.

In the roentgen picture neoplastic forms with endogastric development produce defects with well delimited and rounded borders. The contour of the wall, however, is not altered and the peristalsis is not disturbed. In carcinomas, on the other hand, the picture shows multiple defects with indistinct contours. Peristalsis is abolished and the gastric wall is rigid.

Sarcomas which develop within the lumen of the stomach cannot be differentiated roentgologically from benign tumors.

Concerning those neoplastic forms which develop exogastrically and which are usually characterized by voluminous pedunculated or sessile masses implanted on the wall of the stomach, the difficulty consists in differentiating them from certain tumors which arise independently from the stomach but which, on account of being in its vicinity, have become adherent to it. This may give rise to deformations of the stomach and to the appearance of configurations suggestive of diverticula. These alterations may become so pronounced as to impair peristalsis even in the absence of any intrinsic changes of the gastric wall.

Often x-rays will not aid diagnosis, especially in the presence of infiltrating sarcomas. These tumors are easily confused with common carcinomas.

The author concludes by stating that the essential points to be remembered in the roentgenological diagnosis of sarcoma of the stomach are: (1) peristalsis may or may not be present; (2) the stomach wall is usually rigid; (3) sarcoma usually spares the gastric orifices so that a pyloric stenosis, for example, is never produced although a pyloric incontinence usually develops; (4) an atypical picture of carcinoma is always strongly suggestive of the presence of a sarcoma. RICHARD E. SOMMA, M.D.

Balfour, D. C.: Indications for Operation in Cases of Gastric Disease. *Surg. Clin. North Am.*, 1937, 17: 947.

The common indications for operations in chronic duodenal ulcer, aside from those complications which may of themselves clearly call for operation, are chronicity and sufficient severity of symptoms which cannot be controlled by adequate medical treatment. In addition, the age, sex, occupation, and disposition of the patient must be taken into consideration, because all these factors influence the result of any form of treatment.

There are certain general principles in the management of duodenal ulcer which have become well established. Since it is not a malignant disease, and since the serious complications are relatively rare, emergency measures are required only in the event of acute perforation. In a large percentage of cases of duodenal ulcer, the disease may be controlled by adequate medical management.

The fundamentals of treatment have not materially changed. Frequent feedings of an adequate amount of food have been shown to be very important, and Mann has demonstrated, in dogs, that feeding at frequent intervals is a major factor in controlling gastric acidity. More recent developments in medical management have been the use of such buffer agents as mucin, and the use of extracts of duodenal mucosa; the latter has been shown experimentally to have an inhibitory action on gastric secretion. The early reports of the results of any treatment of duodenal ulcer must take into consideration the prompt relief of symptoms, which usually comes only from rest.

Surgical treatment of duodenal ulcer in its early stages may be indicated in those cases in which symptoms are severe and do not respond to treatment, or the patient is unwilling or unable to persist in a satisfactory regimen. In such cases (because the patient is young, there is usually no motor impairment and gastric secretion is hyperactive) gastroenterostomy should be avoided, for the incidence of jejunal ulceration is high in such circumstances.

The results of the surgical management of duodenal ulcer will depend to a large extent on the skill with which cases are selected for operation.

The general principles of management are secondary in importance to the selection of patients for operation for duodenal ulcer. All surgical procedures have a common purpose, that is, to modify gastric function; and apparently the results of operation are

in direct ratio to the degree that gastric function is modified, particularly in its secretory mechanism. At the same time, the ideal to be sought for would appear to be to modify gastric function only sufficiently to cure the ulcer and to prevent the recurrence of the disease.

Partial gastrectomy and posterior gastro-enterostomy are the most effective procedures in the treatment of duodenal ulcer.

The second general principle of surgical management for duodenal ulcer involves operations on the outlet of the stomach in an endeavor to modify gastric function by permanent ablation of the pylorus.

The first indication for operation in gastric ulcer is that, regardless of the history which the patient may present, if the lesion which is demonstrated roentgenologically does not heal satisfactorily in a reasonable length of time by medical treatment, the surgeon is not fulfilling his responsibility unless he advises the patient to have the lesion removed. The chief advantage is that the small gastric ulcer can be removed satisfactorily by either knife or cautery, the defect closed, and gastro-enterostomy performed with every assurance of an excellent and permanent result. This type of operation, namely, excision and gastro-enterostomy, is an ideal procedure for the small gastric ulcer.

When ulcers are situated in the upper segment of the stomach, operation perhaps should not be advised so readily, and more intensive and prolonged medical treatment may be justified. The lesions in the upper part of the lesser curvature, however, usually can be dealt with directly by local excision after the lesser curvature has been mobilized by the division of inflammatory adhesions which are routinely found in such cases. When partial gastrectomy can be done with little more risk than excision and gastro-enterostomy, it can never be condemned for gastric ulcer. It is important to remember that gastro-enterostomy alone for gastric ulcer has proved in many cases to enhance the capacity of healing the lesion, provided of course it is not malignant.

The indications for operation in cases of benign tumor are clear when they have been demonstrated roentgenologically. When a tumor which has been responsible for bleeding is visualized roentgenologically, the indication for removal is clear since the operation can usually be done satisfactorily without more than incidental risk. The chief indication at operation in such cases is to be aware of the fact that these tumors may be multiple even though only a single lesion has been demonstrated by the roentgen rays.

Diverticulum of the duodenum is not of great surgical importance because of the rarity with which operation is indicated in such cases. It is only when such diverticula are of great size, or in very rare instances in which complications have occurred, that any surgical procedure should be seriously considered.

In this country very little interest has been shown in the proposal of gastric resection for gastritis. From a surgical standpoint, gastritis is more a problem of academic interest, that is, the relation of gastritis to ulcer and gastric cancer, and its place as a factor in disappointing results after operation. The general impression among clinicians at the moment is that the condition is one which usually can be remedied easily by suitable medical management, and there is an increasing possibility of diagnosing the condition both by its clinical manifestations and by means of the gastroscope and fluoroscope.

Indications for operation in cases of cancer of the stomach depend on many factors, and first, on whether or not a positive diagnosis can be made. The profession is well aware of the danger of dealing with a small cancer of the stomach on the assumption that it is a gastric ulcer, but the very fact that this is now well known has greatly decreased the number of such cases.

The frequency with which cancer, as we see it, develops in gastric ulcer must be comparatively small because of the high incidence of cancer of the stomach and the relative rarity of gastric ulcer. The question of advising operation for a small gastric lesion which has all the appearance of being an ulcer on the score that it may be malignant, will have to be determined chiefly by the degree of distress that the patient is having from the ulcer, the amount and kind of treatment he has had for it, whether or not by roentgen examination there are signs of healing, and the risk of a surgical procedure. Unless symptoms are quite uncontrollable by medical treatment, and unless unquestionably adequate treatment has been applied, these small gastric lesions should be under the observation of a physician who can and will institute intensive medical management, who will be conscious of the possibility of the lesion actually being malignant, and who will, therefore, keep the patient under close observation from a clinical and roentgenological standpoint.

Another group of cases in which there is some uncertainty on the score of diagnosis are those in which symptoms may arouse suspicion that malignant disease is present, but in which the latter fact cannot be confirmed roentgenologically. In the records of the clinic from 1906 to 1931 only 25 patients were sent to the hospital for operation because of a clinical diagnosis of cancer of the stomach when the roentgenologist reported a negative stomach. No better evidence of how the expert roentgenologist can convince the surgeon of the accuracy of his method can be found than this.

In addition to this group are cases in which patients were operated on for other abdominal conditions, and in which cancer of the stomach was encountered although the roentgenologist's study of the stomach had been negative. A further debatable group, insofar as uncertainty of diagnosis is concerned, consists of those cases in which spasm either of the antrum or pylorus appeared to represent an organic lesion and in which a diagnosis of cancer of the stomach was made but could not be confirmed by the consulting roentgenologist. Finally, there is

the group of cases in which the expert roentgenologist finds sufficient rigidity of the musculature of the stomach, along with superficial ulceration, to justify the statement that malignancy cannot be ruled out. Such patients should be kept under the closest observation and be repeatedly examined roentgenologically, and if the deformity persists exploration should be advised. In the much larger group the diagnosis of cancer is all too clear, and the question to be decided is whether or not exploration is justifiable.

Among contra-indicating factors is a diagnosis by the roentgenologist of a frankly inoperable cancer. The surgeon will have in mind the fact, however, that the nature of the cancer, even though it seemed to the roentgenologist to involve too great an area of the stomach, may make possible an extensive resection with some possibility for cure, or a great probability of real palliation. The investigation for evidence of metastasis should be most thorough, as the end-results of operation for cancer of the stomach depend to a considerable extent on whether or not metastasis has been meticulously searched for prior to operation. The rectal shelf, the supraclavicular notch, and the occasional thoracic metastatic lesion may easily be overlooked in an incomplete examination.

Having eliminated the possibility of distant metastasis, examination of the tumor, when it is palpable, will disclose findings of importance. Its size is of importance since the significance of a large mass may be much exaggerated; some of the most favorable cases for cure are those of large colloid and well demarcated tumors. A much more important sign than size is the mobility of a tumor, particularly its lateral mobility. Severe pain is of serious import since it usually denotes involvement of the peritoneum. Rapid loss of weight in the absence of obstruction of either cardia or pylorus and any suggestion of icteric scleræ are not encouraging features. Marked secondary anemia in the absence of gross hemorrhage is also an unfavorable sign. The factor of age is important since in the more advanced years there should be less inclination to resect the stomach in those cases in which the lesion is very extensive.

For those lesions which are known to be extensive, and when there is involvement of the stomach, a left rectus incision has very definite advantages, while in other cases a midline incision is usually as satisfactory as any. If there are no evidences of peritoneal implants, the incision should be of sufficient size to admit the hand, enable thorough exploration to be made, and make possible satisfactory mobilization of the stomach.

In respect to the lymph nodes, unless it can be proved that enlarged lymph nodes outside the range of removal are malignant and that there is other evidence of distant metastasis, it may be assumed that it is possible that these lymph nodes are only inflammatory, and resection can be carried out.

In the largest group of cases of cancer of the stomach a decision can promptly be made in respect to confirming the diagnosis and determining the best method of management. In the case of larger tumors it may first appear that removal is not feasible. As a matter of fact, the survival rates among patients with large lesions as contrasted with those with small lesions showed at the end of seven years that 33 per cent of the former were alive whereas only 24 per cent of the latter were alive.

If exploration discloses a small nodule in the liver or an implant on the rectal shelf, experience has shown that it is frequently to the advantage of the patient to perform palliative gastrectomy. When there is any indication of diffuse abdominal metastasis and when free fluid is present, any type of palliative operation is of questionable value except, possibly, when a high degree of pyloric obstruction is present, but even then gastro-enterostomy is likely to prove disappointing in its effect in relieving the obstruction. Lesions that are more or less confined to the antrum are usually resectable unless extragastric involvement precludes removal of all malignant tissue. Extension up along the lesser curvature, particularly in the scirrhous type of cancer, is all too frequently the reason for inoperability.

A very important group of cases is that with circumscribed growths high in the fundus which are chiefly on the posterior wall and greater curvature, for in these cases local excision can frequently be done with as good prospects of cure as with extensive gastrectomy. When small lesions are readily accessible, they should be removed either by local excision and gastro-enterostomy, or by gastric resection, but when they are so located that their removal would entail a great risk, it is often better to assume that they are benign and perform only gastro-enterostomy.

When gastric resection is advisable, the methods by which it is carried out will vary with the preference of the surgeon, the location and extent of the growth, and the technical difficulties encountered. When recurrence takes place after the Billroth II procedure or any of its modifications, mechanical difficulties are not frequent, and for this reason the Billroth II procedure is preferable for cancer.

When any technical difficulties are encountered in the Billroth II operation because of obesity or a short mesocolon, an anastomosis in front of the colon has very definite advantages. Of the palliative procedures, by far the most important is that by which the growth is completely excluded. This can be accomplished by employing the exclusion operation recommended by Devine for duodenal ulcer which, in suitable cases, is an extremely valuable palliative measure in cancer. It affords complete relief from the actual or impending obstruction and results in very definite prolongation of life in comfort. Palliative gastro-enterostomy is now generally recognized as too frequently being disappointing and is indicated but rarely.

With modern diagnostic methods, as a result of which cancers are seen in their earlier stages, the operability rate is about 43.5 per cent for those cases

in which exploration is carried out, and the mortality in those cases in which resection is carried out is between 10 and 13.9 per cent. The chief cause of death remains rather consistently peritonitis or pneumonia, or both, since either one or both of these conditions are present in 70 per cent of the cases in which death occurs.

When partial gastrectomy is possible, regardless of the degree of involvement of lymph nodes, the extent of resection, or whether the procedure is done as a palliative measure, approximately 32 per cent of the patients are alive and well five years after operation.

Marshall, S. F., and Kiefer, E. D.: Partial Gastrectomy for Gastric or Duodenal Ulcer. *J. Am. M. Ass.*, 1937, 109: 1341.

Two hundred and forty-two patients were operated upon in the Lahey Clinic for gastric, duodenal, or gastrojejunal ulcer in the ten years from January 1, 1927, to December 31, 1936. During this time specific clinical features have proven to be definite indications for surgical intervention in the management of patients with duodenal ulcer. These were:

1. Pyloric obstruction with symptoms of active ulcer commonly due to spasm, infection, or edema. In most cases the symptoms could be relieved by rest, diet, and alkalies. Recurrent attacks of acute ulcer may, however, eventually produce scarring of the pylorus, shortening of the duodenum by scar formation, and real cicatricial stenosis which necessitates surgery.

2. Gross hemorrhage was found to indicate a somewhat more severe type of ulcer and its presence to decrease the probability of successful medical treatment. The occurrence of gross hemorrhage despite adherence to the ulcer regimen was a definite indication for surgical intervention because the prognosis with continued medical management was poor. Gross hemorrhage itself is a serious complication in ulcer patients, having a definite mortality of at least 5 per cent. This has led to the establishment of hemorrhage as a surgical indication.

The indications for surgical intervention in cases of gastric ulcer are somewhat different because of different clinical features in gastric lesions as contrasted to duodenal ulcer, and partly because of the technical difficulty in differentiating between some gastric ulcers and early carcinoma. Sara Jordan has shown that a large percentage of gastric ulcers will heal readily and completely with medical treatment. Surgical intervention is therefore indicated only for that gastric ulcer, which, because of the large size of the crater or extension into the adjacent tissues, proves impractical for medical measures, and for that type of gastric ulcer which, because of insufficient tendency to heal during medical management, is suspected of being an early carcinoma.

The selection of the type of surgical procedure is complicated by many factors. Gastro-enterostomy in properly selected cases is indicated because of its low mortality rate and smooth convalescence. It should, however, be restricted to patients who are past middle age, have low acid content and who have considerable cicatricial pyloric obstruction. In this type of patient the best results are obtained.

Gastrojejunal or jejunal ulcer is the most serious complication occurring after gastro-enterostomy. The reported incidence of its occurrence has ranged between 1.7 and 24 per cent, and it is the opinion of the authors that the percentage is nearer 24 than 1.7 per cent. Postoperative jejunal ulcer may also occur after partial gastric resection but much less frequently than after gastro-enterostomy. In this series of 102 patients, 5, or 6.7 per cent, had postoperative ulcers after resection.

The gross benefit accomplished by surgical management of ulcers results from the change in the gastric secretory and motor function. There is little

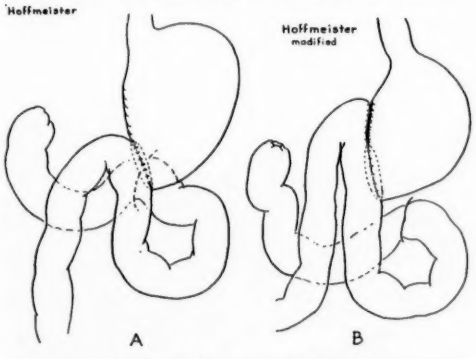

Fig. 1. A, the Hoffmeister type of gastrojejunal anastomosis following subtotal gastrectomy. B, a modification of the Hoffmeister anastomosis reinforcing the closed end of the stomach with jejunum. This is considered the procedure of choice.

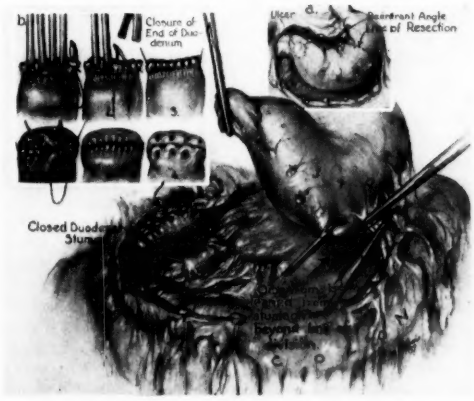

Fig. 2. The stomach is mobilized and the duodenum divided; a, line of resection of the stomach; b, method of closure of the duodenal stump.

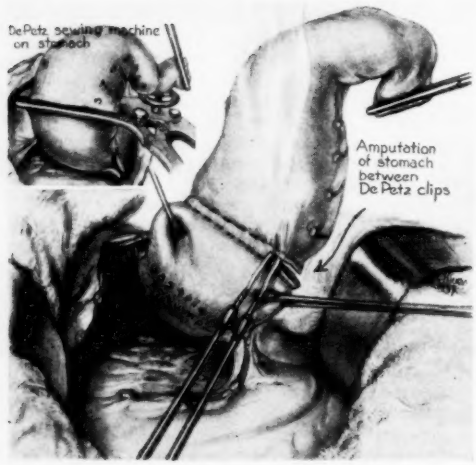

Fig. 3. The stomach is divided by cautery between the double row of clips applied by the de Petz clamp. Inset shows the application of the de Petz sewing clamp.

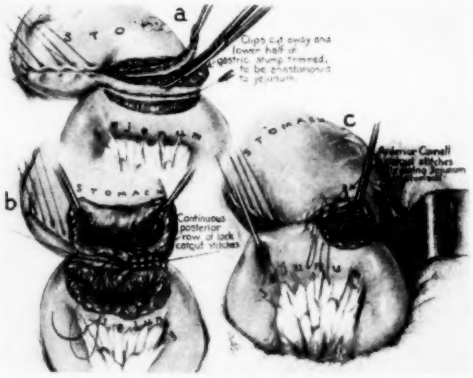
a
Clips cut away and lower half of gastric stump trimmed, to be anastomosed to jejunum
b
Continuous posterior row of lock I catgut stitches
c

Fig. 4. Hoffmeister method of gastrojejunostomy; the upper half of the divided end of the stomach is closed, inverting the clips. The jejunum is sutured to the remaining portion of the stomach. The clips are cut away in this area and the jejunum is incised, forming the stoma; the anastomosis is then completed.

doubt that of all the surgical procedures partial gastrectomy accomplishes this change best. It is an operation of considerable magnitude beset with many technical difficulties and may be accompanied by a considerable mortality even in the hands of the most experienced and skillful surgeons. The authors have been able to reduce their mortality from 18 to 11 per cent. The death rate from subtotal gastrectomies was influenced first by the surgical technical factors associated with the operation and by the anesthesia, as well as the group of factors pertaining to the general physical condition of the patient and the pathological picture of the ulcer. These include size, depth, location, chronicity, and surrounding tissue involvement.

During the past ten years under consideration, 1,930 patients with duodenal ulcer were studied at the Lahey Clinic and 157, or 8 per cent, were operated upon. Of 192 patients with gastric ulcer, 44 were treated surgically. In 18 of the patients who were operated upon the ulcers were so adherent to the pancreas and the common duct that removal would have been followed by a mortality so high that the surgeons had no justification in persisting in their excision. These patients were treated by a Finsterer type of resection for exclusion, the fact kept in mind that in the presence of a high-grade pyloric obstruction there is grave danger that accumulating secretions above the stenosis will cause separation of the suture line leading to a fatal leakage. Once having decided on a radical attack on the ulcer the surgeon should really remove the stomach radically. Pylorectomy and antrumectomy have practically the same mortality as partial resection, with little advantage over a gastro-enterostomy. Partial gastrectomy means removal of at least three-fourths or four-fifths of the stomach. "The operation should be radical enough to produce anacidity or hypoacidity and a recurrence of the symptoms may follow the failure to obtain this result." If resection of the stomach is sufficiently radical there is little difference what type of anastomosis is made. The Billroth I type of procedure frequently cannot be used for large adherent eroding ulcers because their presence prevents adequate mobilization of the duodenum to permit an anastomosis of the duodenum to the resected stomach segment without dangerous tension. The authors have gradually been favoring the Hoffmeister type of resection (Figure 1).

The removal of the stomach does not present any particularly trying technical difficulties, but painstaking precautions must be taken against contamination from spilling of the gastric contents and hemorrhage. The real technical problem comes with the removal of large gastric ulcers which are penetrating and adherent to the pancreas, and particularly with the removal of deep eroding adherent ulcers of the duodenum.

The surgeons at the Lahey Clinic prefer an abdominal incision to the left of the midline because the pylorus is normally only slightly to the right and is easily approached by a left rectus incision, which permits a better approach to the body and lesser curvature of the stomach. Great caution must be used to prevent injury to the common duct and the pancreas. Enough of the duodenal tube must be left to permit easy inversion and safe suture. Emphasis is placed upon the importance of saving every possible bit of the duodenal tube and of not wasting it by suturing over a clamp. This may be accomplished by opening the duodenum widely and closing it with an in-and-out Connell suture of cat-

gut, or by grasping the divided duodenum with Allis clamps and closing it with a continuous suture of catgut followed by inversion (Figure 2).

A de Petz sewing clamp or a Fredericks modification of it has been utilized to great value by the Lahey group. The cautery is used to cut off the stomach (Figure 6). The upper portion of the resected end of the stomach is then inverted with a double row of catgut sutures reinforced until only a sufficient opening is left at the lower end of the closed stomach for the anastomosis. The jejunum is next brought anterior to the colon to permit a good-sized loop between the ligament of Treitz and the stomach to remain, after which the anastomosis to the cut end of the stomach is begun. Good results have been obtained whether the proximal jejunal loop is placed at the greater curvature or at the lesser curvature. The abdominal incision may be closed in layers by catgut or by means of through and through heavy black silk after peritoneal closure with catgut.

Anesthesia is of maximum importance in gastric surgery. At present spinal anesthesia with diluted nupercaine has been found to afford the greatest possibility for prolonged anesthesia without any undesired drop in the blood pressure.

The disturbing complications were pulmonary, such as pneumonia, pulmonary edema, and atelectasis. These caused 50 per cent of the mortality.

The convalescent period after partial gastrectomy was found to be prolonged. It was a common experience for patients to remain unable to work for from three to six months after leaving the hospital. The final clinical results were satisfactory and compared favorably with the end results of any major surgical procedure.

Of the series of 102 patients on whom gastric resection was done, 74 were accurately followed. The results were good or excellent in 84 per cent. Nine per cent were classified as poor or fair, and these patients had symptoms which were apparently caused largely by functional disorders of the gastrointestinal tract or by neurasthenia. Five patients had postoperative ulcer; 3 of these have recovered with surgical help and are now well; 1 is an invalid, and the fifth has not returned to the Lahey Clinic although he has reported to have had three postoperative hemorrhages. Of the 18 patients in whom a high resection was done with the exclusion type of intervention as described by Finsterer, 15 have been accurately followed and 14 have exhibited no recurrence of symptoms and are apparently in good health. One had a jejunal ulcer eleven months after operation, which responded to medical management. It is important to strive for a postoperative anacidity because of the tendency to occurrence of jejunal ulcer in patients in whom the acid has not been sufficiently reduced by partial resection. Unless anacidity or hypo-acidity is produced by high resection, it is difficult to see any clinical advantage of this operation over gastro-enterostomy.

SAMUEL J. FOGELSON, M.D.

Truesdale, P. E.: Gastrojejunostomy in Retrospect. *New England J. M.*, 1937, 217: 462.

This essay includes the author's experience in the surgical treatment of ulcer with not only gastrojejunostomy, but also the other types of surgical intervention. Postoperative results have demonstrated to Truesdale that "The gastro-intestinal tract is a one-way canal. Gastro-enterostomy is a rational operation when the pylorus is stenosed by the cicatrix of an old ulcer. This operation is illogical when it leaves two openings, both of which continue to function."

The material evaluated consisted of 393 patients with peptic ulcer admitted to the surgical service of the Truesdale Hospital since 1908; 313 were treated surgically by the following methods:

Gastro-enterostomy		185
(In 5 cases the ulcer had perforated, requiring suturing of the perforation in addition to gastro-jejunostomy.)		
Partial gastrectomy or pyloroplasty		74
Billroth I	8	
Billroth II	39	
Pólya	24	
Von Eiselsberg	3	
Suturing of perforation		45
Sleeve resection		2
Excision of ulcer and cauterization		4
Modified wedge incision with elongation of lesser curvature		3
		313

Forty-five of the 50 cases of acute perforated ulcer were treated by suture of the perforation, and 5 by an additional gastro-enterostomy. In the first group, 20 of the 45 patients are alive and well with no symptoms; 6 are obliged to follow a strict diet, and 2 could not be traced. Eleven died in the hospital from various causes. Of the 5 patients in whom gastro-enterostomy was also done, 3 are alive and well, but 2 died of peritonitis. Thus 23, or 46 per cent of the 48 patients traced are alive and well and have no symptoms. Thirteen of the 50 patients died in the hospital after operation, a mortality of 26 per cent for this entire group.

Death occurred in 9 of 185 patients on whom gastro-enterostomy was performed, a mortality rate of 4.9 per cent. Including the patients who died later of carcinoma of the stomach and those with jejunal ulcer and gastrojejunocolic fistula, there were 30 patients or 18 per cent of the 166 traced, who did not obtain relief from gastrojejunostomy.

Among 74 patients treated either by partial gastrectomy or pyloroplasty there were 2 postoperative deaths, a mortality of 2.7 per cent. Thirty-nine of these 74 patients were well and without symptoms; 2 were partially relieved. There were 2 postoperative deaths; 5 from cancer; and 14 other deaths were due to unrelated causes. There were 5 patients in whom the end-results could not be determined, and 7 who could not be traced. None of the 24 cases treated by the Pólya type of gastric resection showed subsequently any serious forms of blood dyscrasias.

Lahey's discussion of this paper is of great interest in that he believed that gastro-enterostomy as a routine procedure for duodenal ulcer is today unjustified. There are too many gastrojejunal ulcers. While one cannot definitely state what the accurate percentage is, it is too high to justify the method as a routine operative measure with which to treat surgical peptic ulcer. Despite this criticism, however, there are cases in which gastro-enterostomy must be employed. It may be used in the "bad risk" patient who cannot tolerate the ideal procedure of subtotal gastrectomy. There are, in addition, certain individuals, notably people past middle life with cicatrizing chronic ulcers at the pylorus producing obstruction and with relatively low acid content, who respond very well to gastro-enterostomy. However, in the young individual who has a high acid content and a prospect of long life and does not have pyloric obstruction, gastro-enterostomy frequently only adds to the ultimate seriousness of the ulcer situation. It is in these cases that subtotal gastrectomy is strongly advocated.

Moreover, in 17 cases in which resection for exclusion was performed, in which the duodenum and the ulcer were undisturbed, and in which a high resection had been done, the "follow-up" showed end-results quite as satisfactory as in those cases in which the duodenum was removed.

SAMUEL J. FOGELSON, M.D.

Butler, R. W.: Traumatic Rupture of Intramesenteric Diverticula of the Jejunum. *Brit. J. Surg.*, 1937, 25: 277.

Multiple diverticula arising at the mesenteric border of the jejunum are rare. Although there is disagreement as to the exact mechanism of their initial formation, there is general agreement that the diverticula initially push out directly into the mesentery and subsequently, as they enlarge, come to lie to one side or the other of the mesenteric border of the bowel. At these sites, they may increase to a diameter of from 2 to 3 in. Their points of origin are related to the vasa recta of the superior mesenteric artery, but whether traction on the wall of the bowel by these vessels is a factor in their formation, or whether the diverticulum is pushed out by increased intestinal pressure along the channels made by these vessels are debatable points. As the diverticula increase in size they become thin-walled sacs, the walls eventually consisting only of atrophic mucous membrane and scattered remnants of muscle covered by peritoneum.

Complications are rare, since the diverticula occur mainly in the first three or four feet of jejunum, in which the intestinal contents are very fluid and relatively sterile. Thus, diverticulitis in this region is rare. Traumatic perforation likewise is rare, the author having found no cases reported in the literature.

The author reports the following case:—

A man aged forty-two years, a carter, was admitted to the hospital under the author's care, with a history of having been kicked squarely in the abdomen by a horse four hours previously. Immediately after the accident he was faint and collapsed, but had no abdominal pain for more than an hour. He then commenced to vomit and complained of intense abdominal pain.

Upon arrival at the hospital he was in profound shock, his pulse was rapid and of poor quality, the abdominal wall was completely rigid, and the liver dullness had disappeared. A diagnosis of rupture of some hollow viscus was made and the abdomen opened by a right paramedian incision. When the abdomen was opened, a coil of small intestine, which proved subsequently to be the jejunum about 14 in. from the upper end, presented itself, with a large aperture with loose everted and pouting edges on its right side at the mesenteric border, from which bowel contents were escaping. The fluid which had already escaped from the perforation was confined mainly to an area to the right of the mesentery immediately around the perforation. This area was quickly packed off and mopped dry and the perforation closed by a purse-string suture, further reinforced by a second which inverted and buried the first.

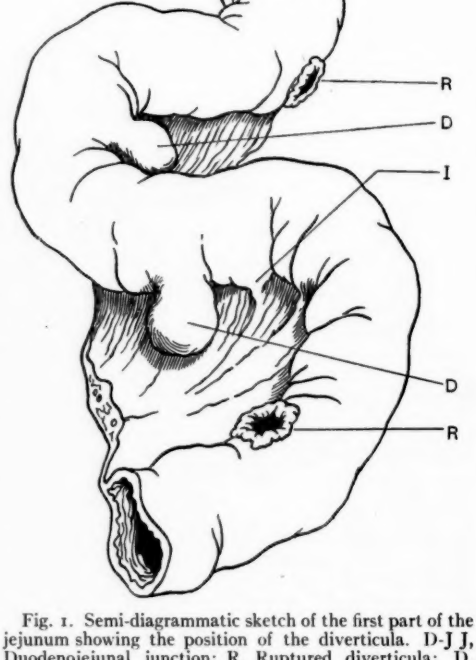

Fig. 1. Semi-diagrammatic sketch of the first part of the jejunum showing the position of the diverticula. D-J J, Duodenojejunal junction; R, Ruptured diverticula; D, Intact diverticula; I, Incipient diverticulum.

At this stage a diverticulum about 1 in. in diameter was found at the mesenteric border of the bowel on the right side of the mesentery about 5 in. above the perforation. The true nature of the perforation as a ruptured diverticulum now was apparent. The curious redundant margin of the perforation was explained as being the flaccid walls of the ruptured diverticulum falling back against the bowel wall.

A rapid survey was made for other diverticula, and another one, intact and of similar size, was found on the left side of the mesentery 4 in. further toward the duodenojejunal juncture.

No diverticula of sufficient size to make them readily distinguishable in the fat of the mesentery were found distally, and there was no evidence of other perforations. The patient's condition was exceedingly poor and the abdomen was closed as rapidly as possible with drainage to the region of the perforation.

Abdominal rigidity and vomiting recurred; the patient's condition remained grave and in spite of all measures to combat shock he became gradually worse and died ten hours later.

At autopsy the abdomen was found to contain considerable quantities of fluid bowel contents, mainly toward the left side and down toward the pelvis. Tucked away behind the first part of the jejunum, only about 1½ in. from the duodenojejunal junction, was a second and much smaller perforated diverticulum which had been missed at operation and had continued to leak into the peritoneum.

Probably at the time of operation traction upon the jejunum had kinked the bowel at this point, temporarily occluded the opening, and hid it still further by turning it away behind the bowel.

ARTHUR S. W. TOUROFF, M.D.

Ochsner, A., and Lilly, G.: The Technique of Appendectomy. *Surgery*, 1937, 2: 532.

Three basic methods of handling the appendical stump are used by various surgeons today. They consist of (1) simple ligation of the stump, (2) ligation and inversion of the stump, and (3) inversion without ligation of the stump. Each of the methods has ardent advocates and proponents. Simple ligation of the appendix has the advantage that it is simple and readily performed. In those cases in which the cecal wall is inflamed and indurated, the introduction of purse-string sutures often is inadvisable because of the inability to invert the appendical stump on account of the thickened and indurated cecum. Ligation of the appendix also insures hemostasis. The disadvantages of simple ligation of the appendical stump are: (1) inadequate closure of the bowel is likely because serosa is not brought in apposition to serosa; (2) the ligated stump which many times is infected lies free in the peritoneal cavity and may be a source of contamination; and (3) adhesions are likely to occur around the ligated stump. A case is reported in which a fatal termination occurred as a result of a blowing out of the ligated stump which was not inverted. A review of the literature shows a

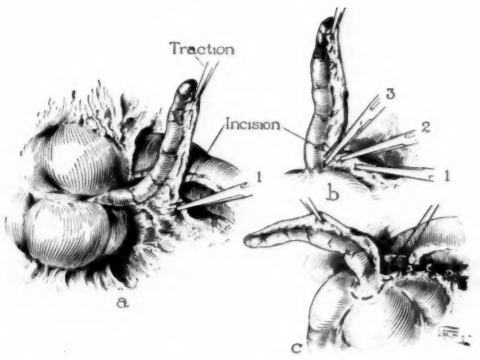

Fig. 1. Method of division and ligation of the meso-appendix, as performed by the authors. As shown in *a*, the meso-appendix is not clamped or ligated *en masse*, but is caught with small forceps and each area divided and ligated individually. Following division and ligation of the meso-appendix a purse-string suture is placed around the base of the appendix as in *c*.

higher incidence of complications following simple ligation of the appendix than after any of the other techniques. Because of the great danger and high incidence of complications, the authors believe that it is just as illogical not to invert the appendical stump as it would be to leave the blind ends of the intestine uninverted following resection and a side-to-side anastomosis. No surgeon would ever advocate and much less practice non-inversion of such a blind stump. Numerous techniques have been devised to secure inversion of the mucosa and close apposition of the serosal surfaces in order that adequate closure of the suture line is secured by the fibrinous reaction of the peritoneum. The safety of gastro-intestinal surgery is dependent upon the presence of the peritoneum and its characteristic reaction, which should be utilized to the fullest extent by carefully apposing serosa to serosa.

Ligation and inversion of the appendical stump have been used because of the high incidence of complications following simple ligation of the stump. The stump is inverted so that it cannot become adherent to other viscera and peritoneal contamination cannot occur from it. Careful apposition of serosa to serosa is secured. A distinct disadvantage, however, is the violation of a surgical principle, viz., the burying of an infected stump in a closed cavity. Many cases have been reported in which an abscess has developed at the site of the ligated, inverted stump in which fortunately, however, recovery usually resulted because of rupture of the abscess into the lumen of the cecum. Such a case is reported by the authors. Another case in which an abscess apparently developed at the site of inversion with the production of peritonitis is also reported; in this case there was a fatal termination. As demonstrated by experimental work, the incidental infection

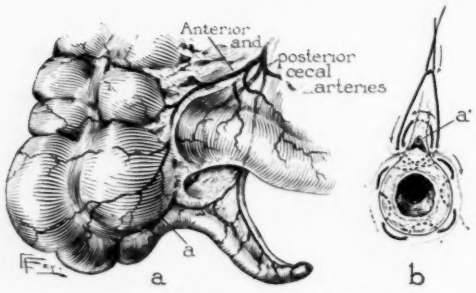

Fig. 2. *a*, Blood supply of the appendix derived from the anterior and posterior cecal arteries: *b*, method of introducing a purse-string suture in such a way as to include a possible intramural branch of the appendicular artery, *a'*. As illustrated in the drawing, the purse-string suture is begun at the anti-mesenteric attachment, passes through the submucosa at the base of the appendix, and emerges on the opposite side of the meso-appendix. It is carried over to the beginning side and reinserted so that a loop, as shown by the arrow, is made around any intramural branch of the appendicular artery. The purse-string suture is then carried around in a conventional manner back to the meso-appendix. In this way the possibility of hemorrhage from an intramural branch of the appendicular artery is prevented.

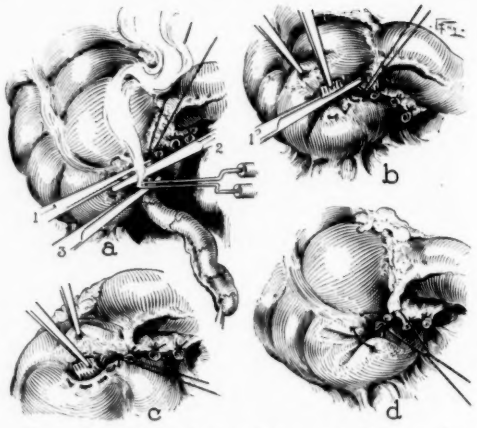

Fig. 3. Technique of appendectomy. *a*, After introduction of the purse-string suture in such a way as to include any intramural branch of the appendicular artery, three crushing clamps are applied to the base of the appendix, and the appendix is divided between the upper (3) and middle (2) clamps; *b*, the upper (2) clamp on the meso-appendix is removed, permitting the operator to grasp the crushed end of the appendix before the lower (1) clamp is removed. In this way the danger of spillage during inversion is obviated; *c*, inversion of the unligated stump into the cecum, following which the purse-string suture is tightened; *d*, further inversion of the inverted stump is accomplished by the introduction of several Lembert sutures over the inverted stump, and as a final procedure the ligated meso-appendix is sutured over the inverted stump, thus peritonealizing the entire area.

around the inverted stump in the closed cavity is much higher than is generally thought, and results in a localized inflammation with the production of peritonitis and adhesions.

In order to obviate the danger of inversion of an infected stump into a closed cavity, inversion of the appendix without ligation has been done. The method described by the authors consists of ligation and division of the meso-appendix. A purse-string suture of No. 1 silk is introduced with an atraumatic needle in such a way as to include an intramural branch of the appendicular artery. This is accomplished by beginning the purse-string suture on one side of the meso-appendix so that it passes down to and includes the submucosa and emerges from the opposite side of the meso-appendix. The suture is reinserted in the same manner, and forms a loop around the mesenteric portion of the cecal wall and encircles any intramural branch of the appendicular artery. This loop suture is tightened to occlude any arterial branch which may be present and the purse-string is continued around the cecum in the conventional manner. After the introduction of the purse-string suture, three crushing clamps are applied to the base of the appendix and the area is walled off with moist gauze packs to avoid any possible contamination or injury to the surrounding structure. The appendix is divided by means of the thermocautery between the upper and middle clamps. By means of a sponge the cauterized portion is wiped away from the middle forceps. The middle clamp is then removed and the crushed tip of the stump thus exposed is grasped with a pair of plain forceps before the third crushing clamp is removed. Traction is then made on the fixed end of the purse string suture by pulling upward on this side of the suture. Traction is also made at a point on the cecal wall opposite this site by catching the tineal band with a pair of toothed tissue forceps and lifting it upward. The remaining crushing clamp is then removed and the stump of the appendix is inverted through the purse-string suture into the cecal lumen by pushing it downward with the smooth tissue forceps with which it has been held. The purse-string suture is drawn tightly as the tissue forceps is gently freed and withdrawn. The site of the inverted stump is carefully compressed with a sponge, and the purse-string suture is tied. The site of the inversion is then reinforced by installing several Lembert sutures over the area of inversion by suturing the stump of the meso-appendix over this same area. In this way the only danger of nonligation of the appendical stump is obviated; viz., any hemorrhage from an intramural branch of the appendicular artery, which is present in about 15 per cent of the individuals, is controlled.

The inversion without ligation of the appendical stump overcomes the objections to the other techniques in that, (1) serosa is brought in apposition to serosa, thus insuring firm healing of the cecal

wound and obviating danger of subsequent leakage from the cecum and peritoneal contamination; (2) contamination is prevented from an infected stump lying free in the peritoneal cavity; (3) careful peritonealization is secured; and (4) the infected appendicular stump is not buried in a closed cavity. Spillage of fecal material during inversion of the appendical stump which has not been ligated is obviated by the use of three crushing clamps, two of which remain on the appendical stump after the appendix has been divided. By removing the upper of these two, it is possible for the surgeon to grasp the occluded stump by means of plain forceps before removing the last clamp. Inversion of the appendical stump without ligation will result in fewer complications and smoother convalescence postoperatively than ligation and inversion, or simple ligation of the stump.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Brailsford, J. F.: The Use of the Erect Position in Cholecystography for the Demonstration of Floating Gall Stones. *Brit. J. Surg.*, 1937, 25: 280.

In routine cholecystographic examination, serial roentgenograms, taken with the patient in the erect position, sometimes will bring out features which may be unsuspected or unrevealed in films that are taken with the patient in the prone position.

The author reports a case in which cholecystographic examination, performed with the patient in the prone position, yielded inconclusive results. When films were taken with the patient in an erect position, however, numerous small, translucent gall stones were seen in the gall bladder. These stones were all of equal specific gravity and were suspended about midway in the depth of the gall bladder, which produced a transverse line across the gall bladder and gave the appearance of an artefact. A film taken with the patient in the vertical position, but tilted to one side, disclosed that the line preserved its horizontal position, and thus the assumption of an artifact was ruled out. Accordingly, the diagnosis made was that of a collection of translucent stones floating in the gall bladder. This diagnosis was confirmed at operation, at which time numerous small stones, each about the size of a millet seed, were found in the gall bladder. The stones were hollow and, when placed in water, floated on the surface. The peculiar translucent, transverse line which was noted in the gall bladder films apparently represented the collection of stones floating at the same level in the gall-bladder bile. ARTHUR S. W. TOUROFF, M.D.

Hill, H. A.: Functional Disorders of the Extrahepatic Biliary System: Biliary Dyssynergia or Dyskinesia. *Radiology*, 1937, 29: 261.

The author has approached the subject of functional disorders of the extrahepatic biliary system with the idea that it may act as an incentive for additional and more critical studies of the extrahepatic biliary system. There is a lengthy discussion of the various phases of anatomy and physiology, and of the motor functions of the extrahepatic biliary system. The physiological disorders of the tract, incidence, clinical findings, roentgenographic findings, diagnosis and treatment, and a discussion of reported cases are dealt with in detail. A bibliography of 120 contributions on this subject is included in the paper.

Adhesions, anatomical kinks, plugs of mucus, inspissated bile, strictures, or external pressure is believed to be the cause of persistence of old symptoms or of new complaints following operations on

Fig. 1. Cholecystograph taken in the prone position.
Fig. 2. Cholecystograph taken in the erect position.

Fig. 3. Cholecystograph taken with the patient obliquely inclined from the erect position.

the extrahepatic biliary tract in the majority of cases. The remaining cases which could not be considered in this category were classed as functional disorders, most of which were disorders of motility. There is experimental and clinical proof that evacuation of the gall bladder is dependent upon intrinsic factors. The intramural portion of the common duct also plays an important rôle in gall-bladder evacuation. The musculature of the gall bladder has been denied any motility by one school of workers, but others believe that the extrahepatic biliary tract functions by means of the intrinsic musculature. The gall bladder and the sphincter of Oddi have been found to be coördinated in their activities by common innervation. In short, the three factors upon which the discharge of bile depends are (1) the secretory pressure of the liver, (2) the contractility of the gall bladder, and (3) the sphincteric action of the intramural portion of the common bile duct. The symptoms of spastic disorders are similar to those of mild gall-stone colic, while gastro-intestinal dyspepsia is simulated in the atonic form of dysfunction. The diagnosis has been found to be dependent upon the findings of the history, duodenal intubation, and roentgenological studies. The treatment of these disorders is both medical and surgical. The final standardization of definite therapeutic regime has not been worked out.

RICHARD J. BENNETT, JR., M.D.

White, B. V., Jr., and Gildea, E. F.: Adenoma of the Pancreas and Hyperinsulinism. *New England J. Med.*, 1937, 217: 307.

A case of hyperinsulinism, subsequently shown to be secondary to an islet-cell adenoma of the pancreas, is reported, together with observations on the effect of changes in diet, emotional factors, and the administration of acid and alkali on the appearance of symptoms. The adenoma was unusual in that it was calcified and situated outside of the pancreas in the surrounding tissues.

A high carbohydrate and a low fat diet was beneficial, while a low carbohydrate regimen obviously increased the frequency of symptoms. Large amounts of alkali or acid did not appreciably affect the appearance of symptoms. Emotional tension could not be definitely established as a factor.

WALTER H. NADLER, M.D.

MISCELLANEOUS

Cullen, T. S., and Broedel, M.: Lesions of the Rectus Abdominis Muscle Simulating an Acute Intra-Abdominal Condition. I. Anatomy of the Rectus Abdominis Muscle. II. Hemorrhage into or Beneath the Rectus Muscles Simulating an Acute Abdominal Condition. *Bull. Johns Hopkins Hosp.*, Balt., 1937, 61: 295, 317.

The authors have written a short monograph on lesions, especially hemorrhage, of the rectus abdominis muscle simulating acute intra-abdominal conditions.

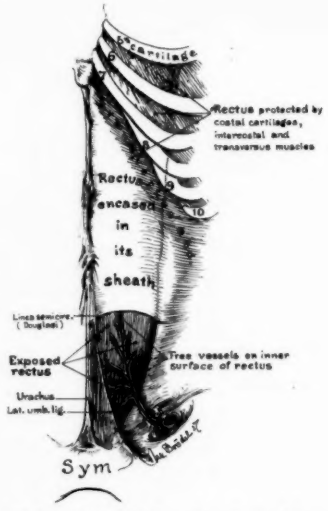

Fig. 1. Vulnerability of dorsal surface of lower rectus.

The first part deals with the anatomy of the rectus abdominis muscle with special reference to its blood supply. The anterior sheath of the muscle covers the entire ventral surface. It is attached to the transverse tendinous insertions. The posterior sheath is shorter than the anterior and ends in the linea semicircularis; below that the rectus muscle has no sheath but is separated from the abdominal viscera by peritoneum and subperitoneal fascia. The posterior sheath is free all the way down to the Douglas line and is not adherent to the rectus at any point. The contracting and relaxing muscle can move freely up and down, and on the posterior surface of this mobile muscle loosely attached to it, runs the large inferior epigastric artery with its two accompanying veins.

Broedel gives a very minute description of the arrangement of the muscle fibers, both grossly and microscopically.

The nerve supply of the rectus abdominis muscle is from the fifth to twelfth thoracic nerves. The nerves enter the rectus sheath in the semilunar line usually accompanied by the insignificant terminal branches of the intercostal vessels. The nerves traverse the posterior surface of the muscle; the sensory branches are usually directed toward the tendinous intersections and hence to the skin. The motor branches curve toward the muscle areas usually accompanying one of the larger oblique branches of the epigastric arteries.

The rectus muscle is supplied with arteries from above and below; from above by the terminal branch of the internal mammary artery and the superior epigastric artery, and from below by the inferior epigastric artery arising from the external iliac

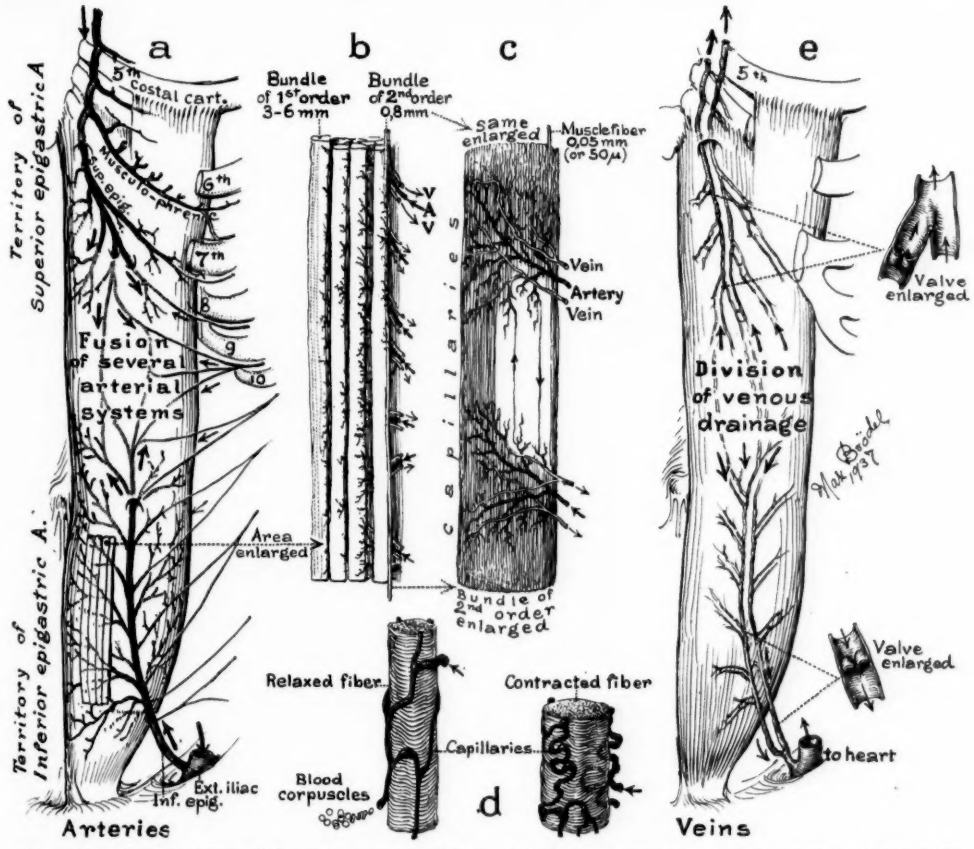

Fig. 2. Dorsal view, diagram of the entire rectus circulation. (a) The main arteries feeding the muscle; (b) the smaller arteries crossing bundles of the first order, each artery has two veins; (c) the smallest arteries crossing bundles of the second order, note short arterioles breaking up into dense capillary network; (d) relaxed and contracted muscle fiber showing difference in capillary pattern, compare size of blood corpuscle (7μ) with width of narrowest capillary (5μ); (e) the main veins and the direction of the blood flow. Excepting the venules, which drain the capillary network, all veins are double.

artery. In the embryo the two sources are independent but traveling toward each other. At the midpoint between the ensiform and umbilicus they meet in an undifferentiated plexus of arterioles. In the newborn the superior and inferior epigastric arteries have joined together through two or three anastomosing channels in the mid-epigastric portion of the muscle. Thus there is one continuous vessel which runs from the internal mammary artery over the entire dorsal surface of the rectus, lying in a shallow groove and adherent to or buried in the muscle for a short distance at the midepigastric region and again detached and mobile down to the external iliac artery. This is important in vagarious contraction and stretching of the muscle. The insignificant terminal branches of the intercostal arteries play only a minor rôle in supplying the muscle with blood. The entire arterial system is accompanied by a double system of veins. The larger veins have valves which direct the blood upward above the midepigastric region and downward in the lower two thirds.

The area of the muscle below the umbilicus has the greatest surgical significance for this is the territory in which rupture and hematomas usually occur. When the inferior epigastric artery has crossed the lateral border of the rectus it ascends on its dorsal surface until it reaches the middle of the muscle. The main artery sends off branches at intervals of from 1 to 3 cm., short or long extramuscular

branches. These usually travel over the dorsal surface for quite a long distance before their twigs plunge into the muscle. This arrangement protects the vessels, the artery and the two veins, in case of excessive muscular activity. The branches enter so they can spread out at nearly right angles to the muscle bundles. If an occasional artery runs parallel to the muscle it shows greater tortuosity. The arterioles come off at right angles from these branches or form a delicate longitudinal network of parallel capillaries. The arteries are less apt to tear than the veins as they are frail, of smaller caliber, and of much thinner wall.

The second portion of the article by Cullen deals with hemorrhage into or beneath the rectus muscle simulating an acute abdominal condition. He reviews the literature and presents histories of 5 cases of hemorrhage. A study of the cases showed hemorrhage following both direct injury and indirect injury of the rectus. Diagnosis of cases due to direct injury is very clear. The symptoms due to indirect injury are very acute. The hemorrhage may be due to tearing of the vessels, rupture of the muscle, or both. The hemorrhage is usually below the umbilicus and limited to one side. In another series it was noted 45 times on the right, 33 times on the left, and only 5 times above the umbilicus. Occasionally there is discoloration of the abdominal skin. When hemorrhage is below the umbilicus the free blood may lie directly against the peritoneum and produce irritation and pain suggestive of an intra-abdominal lesion. He follows with a report of cases from the literature to show the various symptoms noted

Hemorrhage of the rectus muscle has simulated nearly every form of acute abdominal disease, such as appendicitis, twisted ovarian cyst, ovarian abscess, ruptured tubal pregnancy, or intestinal obstruction. In many cases the true condition remained obscure until an incision was made. In cases in which rupture of the rectus sheath had occurred, staining of the abdominal fat was always noticed. Diagnosis of this condition may be very difficult.

Causes of rupture or hemorrhage of the rectus muscle are listed. Rupture may occur from muscular exertion, but usually the patients are suffering from some debilitating or infectious disease. Rupture and hemorrhage are occasionally noted during pregnancy. Rupture often occurred following typhoid fever. This was thought to be caused by the hyaline or waxy degeneration of the rectus muscle frequently occurring in this disease; these changes were known as Zenker's degeneration. Influenza or influenza pneumonia shows a similar degeneration of the rectus fibers, and rupture and hemorrhage occur. Heart disease has a share in the causation of hematoma of the rectus. Hemorrhagic diatheses seem to have played only a minor rôle in the reported cases. Surgical operations are sometimes the cause of the hemorrhage as when the rectus is drawn strongly to one side and causes some bleeding. Additional causes are gall-bladder disease, tetanus, and syphilis.

Treatment, as a rule, calls for opening of the sheath of the rectus, removal of the clot, ligation of any bleeding vessels, and suture of the muscle if necessary. Sometimes the blood is intimately blended with the muscle and cannot be removed. When hemorrhage is slight no operation is required.

Abscess may occur beneath the sheath of the rectus muscle, especially in cases of influenza or typhoid

HARVEY S. ALLEN, M.D.

GYNECOLOGY

UTERUS

Danforth, W. C.: Tuberculosis of the Cervix. *Ann. Surg.*, 1937, 106: 407.

A review of the literature revealed the infrequency of tuberculosis of the cervix. The author reports the only case from his private practice. A biopsy was done because of a lesion which was suspected of being carcinoma. On section this revealed chronic inflammation, small areas of necrosis with giant-cell formation, and typical lesions such as are seen in tuberculosis.

Four types of tuberculous invasion are distinguished: the ulcerative, the miliary, the papillary, and the interstitial. The ulcerative type is usually characterized by a single lesion, the edges of which are rather well defined. The ulcer bleeds easily upon contact but less so than in instances of carcinoma.

The papillary type may be confused with carcinoma, which it may resemble closely. In the miliary variety the cervix is enlarged and small miliary tubercles may be visible on the surface. The interstitial type appears first in the substance of the cervix, forming a nodule which may become necrotic. The necrotic material may be discharged, leaving a cavity.

Tuberculosis of the cervix is, in the great majority of cases, secondary to lesions at higher levels. These, in turn, are usually preceded by lesions elsewhere, usually in the lungs, from which the tubercle bacilli find their way to the pelvis through the blood stream. The method of progression from the uterine body to the cervix may be by continuity of tissue, through the lymphatics, or by the blood stream. The latter is the usual route of infection to the genital tract from an already existing pulmonary tuberculosis.

The symptoms of tuberculous infection of the cervix may not be marked. The evidences of cervical disease may be overshadowed by those of the adnexal involvement which is so frequently present. A moderate leucorrhea may be present, but bleeding is usually absent or small in amount. Any excessive bleeding is likely to be due to a disturbance of ovarian function caused by tuberculous invasion. Tuberculous cervical lesions may be confused with venereal disease or may be mistaken for carcinoma. The latter is far more common and differentiation is important. The typical induration characteristic of carcinoma is absent, and the lesion does not bleed as easily upon contact. Examination of smears may reveal the tubercle bacillus, but care must be taken not to confuse it with the smegma bacillus.

The removal of a small piece of tissue for microscopic study is the most satisfactory method of diagnosis. Animal inoculation may be used, but this is time-consuming and is no more conclusive than histological examination.

The author recommends the following treatment: If the condition of the patient permits, the best management is complete hysterectomy. If the strength of the patient does not warrant radical surgical intervention, or if extensive tuberculous invasion of the peritoneum renders cure very improbable, operation may be withheld. Pulmonary involvement sufficiently advanced that the pelvic tuberculosis is of secondary importance renders operative treatment of the pelvic tuberculosis unwise.

If it is quite certain that the cervical tuberculosis is primary, amputation of the cervix will suffice. It is, however, difficult to be sure of this without an inspection of the reproductive organs and contiguous peritoneum from above. Primary tuberculosis of the cervix, or tuberculous disease limited to the cervix, is found in only from one-fifth to one-fourth of the cases of cervical tuberculosis.

ROBERT M. GRIER, M.D.

Counseller, V. S.: Uterine Myomas. *J. Am. M. Ass.*, 1937, 109: 1687.

Some of the fundamental facts to keep in mind in undertaking treatment of myomas are their blood supply, their cleavage planes, and their manner of growth. Generally speaking, myomas of all sizes are practically devoid of blood vessels. They obtain their blood supply from a thin capillary network from the vessels of the myometrium. For this reason, operation can be undertaken with practically no fear of troublesome hemorrhage. However, this rule does not hold for large pedunculated tumors that have a large pedicle, for the pedicle is usually extremely vascular, and large tumors may be soft and filled with excessive amounts of blood, so that retrograde bleeding from the tumor may be severe.

Tumors that are growing in the myometrium compress the musculature of the uterus around the tumor and have the appearance of being encapsulated. The tumor, which is much firmer than the myometrium, can be readily enucleated when the cleavage plane between the tumor and the myometrium is entered.

The situation of the myoma in relation to the uterus is highly important in selecting the type of surgical treatment. The greater proportion of the tumors are situated in the body of the uterus, usually on the anterior or posterior wall. They are usually designated as subserous, interstitial, or submucous, according to whether they are under the peritoneum, embedded in the wall of the uterus, or under the mucosa. It is frequently in connection with the removal of an interligamentous myoma that the ureter is injured. There is one maneuver which, if carried out at this point, will definitely determine whether one is handling the ureter or not. If the ureter is snipped or otherwise irritated with the thumb forceps, it forcibly contracts; this distinguishes it from blood vessels. Any attempt to re-

move a large myoma in this situation without adequate exposure and without opening the broad ligament wide so that important structures can be readily seen will result in troublesome hemorrhage and perhaps injury to the ureter and bladder. The necessity for determining the position of the ureter and protecting it from injury is further increased by the fact that it may be the only functioning ureter that the patient has left. The other ureter may be congenitally absent or may have been destroyed by disease or by pressure in the broad ligament, or it may have been injured in a previous pelvic operation.

A myoma that extends from the posterior wall of the uterus far down behind the peritoneum of the cul-de-sac of Douglas is one that presents several technical difficulties in its removal. It is usually this type of myoma that is occasionally exposed and considered inoperable; the patient is then subjected to radium or roentgen therapy. If exposure is adequate and the condition thoroughly recognized, the tumor can be removed by careful dissection after retraction of the blood vessels in the fat of the mesentery of the colon.

A myoma that originates from the anterior uterine wall, near the cervix, may cause considerable distortion of the bladder. If in separating the bladder the wall of this organ is injured, it is a much safer procedure to resect the wall of the bladder, leave it attached to the myoma, and then close the bladder with two rows of No. 1 plain catgut sutures.

Myomas that grow toward the uterine cavity form a distinct group and their surgical management is therefore different. As they extend toward the uterine cavity they become fixed beneath the mucosa; therefore they have been called "submucosal myomas." The submucous myoma is frequently troublesome and difficult to identify. Such tumors are often overlooked; if so, the excessive menorrhagia and metrorrhagia continue as they did before. Such patients too often are given a castrating dose of radium or roentgen rays. If the patients are less than forty years of age, these myomas should be removed surgically. Two methods are available:

1. If the cervix is thoroughly dilated the tumor may be grasped with a tenaculum, and then with one hand on the fundus to hold it in position the surgeon may extract the tumor from the uterine wall by careful rotation and gentle traction. Subsequent bleeding is rarely of major importance and is usually controlled by packing the uterus with gauze for from twenty-four to forty-eight hours.

2. If the first maneuver is unsuccessful, the myoma should be removed by abdominal myomectomy. It should always be removed by the latter procedure if there are other myometrial or subserous myomas, which also should be removed.

Pedunculated submucous myomas act exactly as a foreign body in the uterine cavity. As the tumor increases in size the uterus endeavors to expel it, the same as it does a large blood clot. Vaginal myomectomy is the only procedure ever to be employed in the removal of such myomas. Following removal of the tumor, the interior of the uterus should be cleansed with some antiseptic solution, such as an aqueous solution of merthiolate or mercurochrome, or a weak solution of iodine. If bleeding seems excessive, packing with gauze is usually sufficient.

If these pedunculated myomas are associated with others which necessitate an abdominal hysterectomy, this procedure must most emphatically be deferred several weeks until the cervix has assumed a normal consistency and the uterus is free from infection. It is decidedly dangerous to attempt a total abdominal hysterectomy when there is a pedunculated myoma extending into the vagina, since the tumor is always infected and peritonitis is almost certain to follow. The same is true if hysterectomy is attempted too soon following vaginal myomectomy, as the lymphatics will continue to contain streptococci, which may produce a fulminating peritonitis and death of the patient.

Cervical myomas, which fortunately are not common, present one of the most difficult surgical situations in gynecology. Their removal is necessary and always difficult on account of their position and the inherent danger of injuring adjacent structures. When excessive hemorrhages develop they are often treated with the roentgen rays on account of the technical difficulties presented in their surgical removal, which as a rule is inadequate. Unlike the pedunculated myomas which protrude through the cervix, they are not infected; therefore, surgical exploration can be instituted immediately. Myomectomy may occasionally be performed if the fundus is not involved by the tumor (Figures 1 and 2). On account of the tendency of these tumors to grow backward toward the cul-de-sac of Douglas and upward, the abdominal type of hysterectomy is preferable.

Abdominal myomectomy, subtotal hysterectomy, and total hysterectomy may also be considered in the treatment of myomas. The choice of any of these procedures depends on the size, number, and situation of the tumors, on the age of the patient, and on the condition of the cervix. During the sexual life of the patient it is imperative to conserve both the menstrual and the reproductive function. Myomectomy is the only conservative procedure and the operation of choice in the third and fourth decades of life.

All large myomas and all small ones except submucous pedunculated myomas, which produce symptoms after the patient is forty years of age, are treated best by the radical procedure of hysterectomy. Myomectomy may be considered if the patient prefers that the sexual organs be left intact.

Irradiation is often utilized in the treatment of some of the smaller fibroids, especially if it has been previously determined that they are incidental and not primarily the cause of the uterine bleeding. Irradiation at this period of life will be more likely to effect a cure than it will in the earlier years of life, since the recuperative power of the ovary has practically ended.

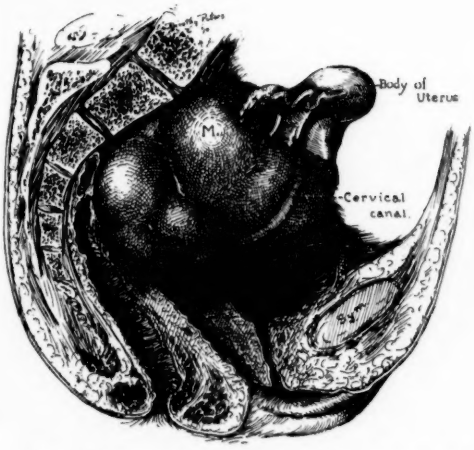

Fig. 1. Diagrammatic sketch of cervical myoma in a young woman whose pelvic organs were otherwise normal.

Fig. 2. Successful removal of the tumor with reattachment of a rim of cervical tissue to the uterus; menstrual function was normal.

The question of whether a subtotal or total hysterectomy should be performed when removal of the uterus is indicated for benign conditions should be determined by the condition of the cervix of the uterus. It is rather generally agreed among gynecologists that the vagina is left in a more normal condition if a normal cervical stump is retained than if the cervix is removed. The cervix should be firm and free from cysts, lacerations, and erosions.

The formation of a support of the vaginal vault following total hysterectomy is a procedure of major importance. It is preventable if the pelvic fascia is accurately attached to the sides of the vagina.

Since operations on the uterus occasioned by myomas are among the most frequent gynecological procedures, each patient must be carefully studied and the method of procedure determined from the position of the myoma, whether the tumors are single or multiple, and from the age of the patient. If hysterectomy is indicated, a careful inspection of the cervix is necessary for choosing between the total or subtotal technique. Finally, the support of the cervical stump or vaginal vault, as the case may be, may determine the success or failure of the operation so far as the patient is concerned.

Todd, T. F.: Pathways and Relief of Pain in Advanced Carcinoma of the Cervix Uteri. *Lancet*, 1937, 233: 555.

Todd describes the two types of pain, visceral and somatic, to be considered in carcinoma of the cervix. Visceral pain is limited to the lower abdomen and pelvis and is typically diffuse. The afferent path is that of the sympathetic nerves. Somatic pain is experienced in the thigh and leg and in the distribution of the lumbosacral nerves. It is unassociated with any visceral lesion and the afferent path is the ordinary somatic one. The criteria used in judging the severity of the pain are important, and may be estimated by the inability of the patient to sleep and her willingness to submit without question to any therapeutic measure suggested. As to the cause of pain, the author considers the process to be due, in most cases, to a root lesion rather than to pressure or metastasis. The method of determining the type of pain in each case is stressed. Once the visceral nature of the pain is diagnosed, the afferent pathway should be sectioned, or the viscus itself attacked.

The author has treated 15 patients for severe visceral pain. In 4 of these, relief was obtained by direct methods. The first patient was found to have rectal pain and tenesmus associated with ulceration and stenosis; here a colostomy produced relief. The second patient presented a necrosis of the uterine wall following gross overdosage with intra-uterine radium in the treatment of menorrhagia; relief followed panhysterectomy. The third and fourth patients suffered severe bearing down pains, ensuing five and eighteen months respectively after treatment of a cervical and body growth; in each case evacuation of the pyometra that had developed was sufficient to give relief. Presacral neurectomy was done in the cases of 11 patients; in 5, for pain associated with a chronic rectal reaction, in which cases it was also hoped that the resulting increased vascularity would accelerate the healing process; in 4, for advancing malignancy involving the bladder and causing extreme dysuria; and in 2 for visceral pain with gland metastases. Sympathectomy relieved them. There was no operative mortality, though the patients were all poor risks. The only complication observed was transient incontinence of urine and feces. Failure in such cases is usually due to the fact that the operation is done when somatic pain exists, and then this method can be of no value.

Somatic limb pain was present in 18 of the patients whose cases are reported. It was found fairly

exactly in the distribution of one or more spinal nerves and was neuralgic in character. Objective neurological signs were not infrequent. All cases were associated with advanced carcinoma of the cervix, which had been treated by irradiation, and all fulfilled the criteria of severity laid down by the author. Bone metastases were never demonstrable.

There are two methods of interrupting the afferent path of the nerves producing this type of pain, i.e., injection of intrathecal alcohol, or chordotomy. The author used the former method with the following details in technique. The injection of ½ to 1 c.cm. of absolute alcohol was given high enough to block the segment producing the pain. The patient was positioned so that the sacral and lumbar spine was elevated, and remained in this position for at least one hour after the injection. No premedication was used. The first patient was treated over a period of eighteen months, and the last one reported over four months ago. In the cases of 2 patients, a successful first injection had to be repeated after an interval of three months. Of the original 18 injections, 4 were not successful. One of the patients refused a second injection, and 3 were given repeated injections with successful results, the relief lasting six, ten, and four months. The maximum period of relief so far has been sixteen months. The average period of relief has been five months per case per injection, and this despite the death, from growths, of 4 patients within one month of the time of the injection.

The author concludes that the adoption of such rational methods of therapy as these should make it possible to dispense almost entirely with opiates in the terminal phases of uterine malignancy. Research is being continued in particular with regard to the cause of the limb pain, and in the study of any late effects of intraspinal injections of alcohol.

HARRY W. FINK, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Iwanow, I. I.: Our Knowledge Regarding Granulosa-Cell Tumors (Zur Kenntnis der Granulosazelltumoren). *Ztschr. f. Geburtsh. u. Gynaek.*, 1937, 115: 262.

Nineteen cases of granulosa-cell tumors were studied regarding the behavior of the gitter or lattice work fibers. The staining method of Tibor Pap and the Azan stain were employed.

The number and the arrangement of the latticed fibers varied greatly. In diffuse extension of the tumor cells there could be found fine meshed nets, even including only solitary cells; at other times there were only very few fibers present. More frequently an extensive development of fibers was found. The trabecular development of the tumor cells was also extensive. Wherever the formation of spherical masses of tumor cells occurred with or without lumen formation, the fibrous mesh was generally much less dense. In follicle-like masses, sharply differentiated and containing secretions, the latticed fibers were missing between the tumor cells. Also in diffuse masses of cells the latticed fibers were scant and were entirely absent where pseudofollicles appeared or where without differentiation of such follicles secretion appeared. Even where there were large cystic spaces lined by granulosa cells the fibers were absent. In normal follicles the theca cells were not surrounded by latticed fibers. The granulosa cells are usually free from these fibers.

It cannot be maintained that the higher differentiation of well developed follicle-like structures develops in association with a higher hormonal content. The fact that these structures are poor in latticed fibers speaks against the belief that higher formal differentiation signifies greater functional development. We also do not know what physiological significance can be attached to the paucity of these latticed fibers in the cellular blocks of cystic tumors. As in the normal follicle so also in the granulosa-cell tumor the cell produces folliculin, irrespective of whether there is differentiation or not. From the arrangement of the latticed fibers no prognostic conclusions can be drawn. It is impossible to tell benign from malignant cases from the difference in number or arrangement of the latticed fibers.

(FRANKL). LEO A. JUHNKE, M.D.

Simecek, A.: Diagnosis of the Krukenberg Tumor. *Am. J. Cancer*, 1937, 31: 21.

Since the time of Krukenberg in 1896, "all ovarian tumors which enlarge the ovaries uniformly without distortion, which present alterations of fibrous areas with mucinous-cell groups, and which propagate along the lymphatics are called Krukenberg tumors." These tumors occur with the greatest frequency in women about the age of thirty-five. They are bilateral in most instances and produce a general enlargement of the ovary, which keeps its form and is usually free of adhesions. They are accompanied by ascites; they metastasize early, and are almost invariably fatal. The original concept that these tumors are primary in the ovary has been refuted by most pathologists who agree that pure Krukenberg tumors are always secondary to carcinoma elsewhere. They are seldom diagnosed before operation or autopsy, and perhaps not even then.

The case reported by the author illustrates the difficulty of the clinical diagnosis of Krukenberg tumors and of diagnosis even at autopsy. There is often a remarkable disproportion between the size and extent of the primary tumor and its subsequent metastases. Grossly the intestinal tract may appear negative and only upon detailed search is a small suspicious area found, which in microscopic section enables the pathologist to make a diagnosis.

The patient whose history is outlined in the report was a white housewife aged thirty-three who complained of swelling of the labia majora of two years' duration. The legs had been edematous for the past year, and the edema had gradually increased and extended upward to the abdomen and back. The menstrual history was not significant. Upon en-

trance examination the patient was described as cachectic. Gynecological examination revealed a small uterus and on the left side a large tumor filling the lower abdomen and extending to about two fingers below the umbilicus. Another smaller tumor could be palpated in the right lumbar region. A diagnosis of cystadenoma of the ovary was made; in spite of a transfusion the course was rapidly downhill and death ensued three weeks after entrance.

At autopsy the gastro-intestinal tract was negative except for an inconspicuous ulcer of the lesser curvature of the stomach which was situated near the pylorus and measured 2 cm. in diameter. The abdominal cavity contained 3 liters of opalescent fluid. Large tumors of both ovaries were found, the surfaces of each consisting of irregular, yellowish-white nodules. On section the tissue appeared somewhat gelatinous with several whitish areas of more compact consistency. Microscopically the structure was quite characteristic of the Krukenberg tumor. Sections from the ulcer in the stomach showed the mucosa entirely replaced by tumor tissue which penetrated directly into the submucosa where the cells were of the signet-ring variety seen in Krukenberg tumors. The author believes that the growth here was primary and not metastatic. The path of transmission of the growth could not be determined in this case since metastases were so widespread and probably involved the lymphatics and blood stream.

HARRY W. FINK, M.D.

Mocquot, P., and Rouvillois, C.: The Arterial Blood Supply of the Ovary from the Viewpoint of Conservative Surgery (La vascularisation artérielle de l'ovaire, étudiée en vue de la chirurgie conservatrice). *Mém. l'Acad. de chir.*, Par., 1937, 63: 1061.

Mocquot and Rouvillois present a study of the arterial blood supply of the ovary. In this study they use the term tubo-ovarian to designate the artery usually called utero-ovarian.

In 12 specimens studied, the ovarian branch of the uterine artery formed a direct anastomosis with the ovarian branch of the tubo-ovarian artery, and the branch thus formed extended along the hilus of the ovary and sent arterioles "like the teeth of a comb" into the ovary along the entire course. In some cases a group of these arterioles originated from a single short branch coming from the main branch. Sometimes there was a secondary anastomosis which either followed the course of the main branch closely or was found in the mesosalpinx. In these cases it was impossible to separate the territory supplied by the uterine artery from that supplied by the tubo-ovarian artery. In another variety of this type arterioles entered the artery from each end of the main branch but not from the middle. In this type a ligature placed at one pole or the other of the ovary did not interfere with the blood supply of the organ.

Another type of ovarian blood supply was also found in 12 specimens. In one variety of this type

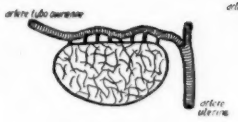

Fig. 1.

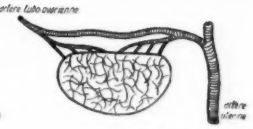

Fig. 2.

Fig. 1. Anastomosis without distinction of areas supplied by uterine and tubo-ovarian arteries.

Fig. 2. Anastomosis with distinct territories supplied by the uterine and the tubo-ovarian arteries.

there was an anastomosis between the ovarian branches of the uterine and tubo-ovarian arteries, but the external portion of the branch thus formed was at a considerable distance from the ovary, and the arterioles that entered the ovary from this portion were long. In another variety of this type, the ovarian branch of the tubo-ovarian artery sent arterioles into the ovary, while another branch formed an anastomosis with the uterine artery; the latter also had an ovarian branch which sent arterioles into the internal half of the ovary, while another branch formed the anastomosis with the tubo-ovarian artery; this anastomosis sent no arterioles into the ovary. The blood supply from the uterine and the tubo-ovarian arteries in this type was distinct.

In a third type, found in only 4 of 30 specimens, the blood supply of the ovary came entirely from the uterine artery; the ovarian branch of this artery passed along the ovary, and sent arterioles into it. At the upper pedicle of the ovary it was drawn upward, forming a curve, and there the tubo-ovarian artery entered it, but the latter was small in caliber; in 1 case no tubo-ovarian artery was seen.

In 2 cases the blood supply of the ovary came from the tubo-ovarian artery; no arterioles entered the ovary from the uterine artery or its branches.

It was evident that the blood supply of the ovary was independent of the blood supply of the fallopian tube, and with proper precautions not to injure any of the vessels supplying the ovary, the tube could be removed without interference with the ovarian blood supply.

ALICE M. MEYERS.

MISCELLANEOUS

Mussey, R. D.: The Management of Pelvic Inflammation. *Surg. Clin. North Am.*, 1937, 17: 1115.

ACUTE PELVIC INFLAMMATIONS

Gonorrhea. The gonococcus is said to cause between 70 and 80 per cent of inflammatory lesions of the pelvis; postabortal and postpartum infections are responsible for a large part of the remainder, while from 5 to 10 per cent, and particularly tubal lesions, are due to tuberculosis. Among women with pelvic inflammation, the two chief causes of chronic inflammation are nearly reversed in the relative frequency of occurrence, and there are comparatively few cases of tuberculous involvement.

It has been said that gonorrhea is responsible for more pelvic conditions necessitating surgical treatment than any other disease. The gonococcus is a surface invader, entering the mucosa through an abrasion which may be so slight as to be unnoticed. In favorable cases, the infection does not get higher than the cervix where the organism "burns itself out," sometimes in a comparatively few weeks and usually within a year.

When the protective barrier is dislodged or overcome by coitus, physical activity, overzealous treatment, or menstruation, the organism passes from the cervix into the uterus, through which it travels as a surface invader on the endometrium, which offers a passageway but not a haven, and thence into the tubes. The accompanying congestion and exudate may produce closure of the fimbria, or the infection may involve the ovary or, locally, the peritoneum.

It is rare for gonorrheal infection to pass through the walls of the fallopian tube. In the lumen of the tube damage occurs from destruction of the mucosa and from the formation of adhesions which may form sacculations in some areas; in others it narrows and may entirely obstruct the lumen. This is a common cause for sterility. One or both ovaries may be involved by a surface infection or a deeper abscess formation. The peritoneum may be more or less involved, and result in local areas of peritonitis or general pelvic peritoneal inflammation; adhesions may involve the sigmoid, small bowel, uterus, and bladder, as well as the tubes and ovaries, and produce more or less distortion in the normal relationships of the pelvic viscera.

In postabortal or postpartum infections, the predominant organism is the streptococcus which usually spreads by the lymph channels and reaches the cellular tissue in the parametrial areas, in the folds of the broad ligaments, and in the tissue overlying the rectum. The fallopian tubes are involved secondarily and from without, rather than primarily and from within, as in gonorrheal infection.

Prophylactic management. Emphasis may be placed on the precautions which must be taken against the development of postgestational infection or against the upward spread of an acute gonorrheal infection. Mention should be made of the necessity for asepsis in the management of labor and the avoidance of all unnecessary vaginal examinations and operative deliveries. The utmost care must be exercised in cases of induced abortion, especially when is incomplete, or in cases of febrile spontaneous abortion. The introduction of an instrument into the uterus in such a case is apt to disturb the protective barriers and release infection into the lymph or venous channels. In such cases, products of conception may be removed from the os cervix, but it is unwise to enter the uterus unless dangerous hemorrhage occurs.

In the presence of acute gonorrhea involving the cervix, care must be taken to prevent the extension of the infection beyond the cervix. More harm may be done by overzealous treatment than by no treatment at all. The patient should be warned to avoid physical activity, especially during the menses; to avoid pressure douches, or any douche if the os is patulous; to avoid alcoholic drinks; and above all, to avoid sexual intercourse. The physician will do well to avoid active treatment of the vagina, or cervix, or manipulation of the pelvic structures, which, by its trauma or disturbance of the protective barrier, may permit the upward passage of the infection. Rest in bed in the Fowler or modified Fowler position; mild laxatives, or small enemas taken under special precautions to avoid producing proctitis; and a light diet and sedatives, as indicated, will usually serve to avert salpingitis. In fact, cures may be obtained without any other treatment. For many women this type of management is impossible because of economic conditions, but even then the treatment should be most gentle; possibly consisting only of the instillation of a mild antiseptic into the vagina until the infection "cools off."

Differential diagnosis. There are several acute pelvic and lower abdominal lesions with which acute gonorrheal salpingitis may be confused. Chief among these are acute appendicitis, acute pyelitis, tubal pregnancy, postabortive cellulitis, and acute tuberculous salpingitis.

The onset of pelvic symptoms may be sudden, as in any of the aforementioned conditions; the pain is pelvic rather than general abdominal, and tenderness is bilateral and lower than in acute appendicitis. In the presence of acute salpingitis, vaginal examination usually reveals tenderness on movement of the cervix or pressure on the corpus, and tenderness and enlargement of the tubes. The history of a missed period followed by persistent slight uterine bleeding, a unilateral tubal mass which is less tender than an inflammatory mass of equal size, and a positive biological test for pregnancy, will indicate the presence of ectopic pregnancy.

Management of acute gonorrheal salpingitis. This consists essentially of rest in bed, the application of cold or heat to the lower portion of the abdomen, the Fowler position, adequate fluids, and later a light diet, mild laxatives or small enemas, and little if any active treatment. Bimanual examination of the pelvis, if done, should be gentle. The acute phase of the disease may be characterized by a high or relatively high fever, sometimes chills, pelvic pain, and splinting of the lower abdominal muscles, and sometimes distention. When symptoms indicate that there is diffuse pelvic peritoneal involvement or, perhaps, general peritonitis, opiates are given to check peristalsis and fluids are given intravenously or subcutaneously, and not by mouth; duodenal drainage may be indicated. Surgical treatment of acute pelvic inflammation is contra-indicated unless an abscess forms and "points" in an area which can be drained without the removal of tissue.

Fever therapy. Improvement sometimes follows the artificial production of fever with its accompanying leucocytosis and acceleration of blood flow. Artificial fever may be induced by the injection of

foreign protein, such as typhoid vaccine or sterile milk. This method of treatment has some merit.

The temperature of the human body can be raised artificially to as high as 105° or 107° F. and maintained at this temperature for a number of hours under carefully regulated conditions without harmful effects. Various methods of producing heat in cabinets enclosing the entire body of the patient except the head, have been devised. Desjardins, Stuhler, and Popp have described the use at the Mayo clinic of the hypertherm cabinet, devised by Simpson in collaboration with Kettering. Sufficient heat is produced to raise the rectal temperature of the patient to 105° F. in sixty to ninety minutes. A body temperature of 105° to 106° F. is maintained for about five hours on the first day of treatment. While the patient remains in the cabinet, cold is applied to the forehead, and to counteract profuse sweating the patient is given copious amounts of iced salt water (0.6 per cent saline solution) to maintain a mineral and fluid balance. A nurse is in constant attendance and a physician is at hand. Treatments are given every third or fourth day. On the second and subsequent treatments the temperature of the patient is kept at 106° to 107° F. for six hours. An average of six treatments has been given.

More recently, Randall and Krusen have increased the length of the sessions of fever and reduced the number of sessions, and treatments have often been accompanied by the use of the vaginal diathermy or Elliott vaginal bag at an average heat of 125° F. This maintains a greater local heat than has been possible by raising only the body temperature. The disease is not considered cured until four to six negative cultures are obtained, at least one of which is taken, if possible, directly following a menstrual period. This treatment is not without risk, as deaths have been reported by various observers.

Fever therapy may be employed for neisserian urethritis and cervicitis not complicated by salpingitis or for those patients with acute or chronic salpingitis whose general condition will permit. When salpingitis is accompanied by symptoms of acute pelvic peritonitis, treatment is usually deferred until there is evidence of local resistance to the infection. Cabinet heat treatments have been followed by more than 85 per cent of cures in more than 200 cases of acute or chronic gonorrhea with or without tubal involvement.

CHRONIC PELVIC INFLAMMATIONS

Differential diagnosis. When chronic inflammation of the pelvis is encountered, it is necessary to rule out certain other conditions before proceeding with treatment. Chief among these are: tuberculosis of the adnexa, chronic diverticulitis of the sigmoid, infected uterine myomas, infected ovarian cyst, chronic appendiceal abscess, and pelvic endometriosis. Any of these conditions may simulate chronic pelvic inflammatory disease, and it is not always possible to make the differential diagnosis. It is not always possible to determine whether the condition is associated with, or secondary to, gonorrheal salpingitis, or whether it is a sequel to pelvic cellulitis resulting from postgestational infection.

Gonorrheal disease of the fallopian tubes tends to become self-limited unless reinfection occurs. On the other hand, the infectious organisms of pelvic cellulitis, chiefly streptococci, tend to remain viable in the affected tissues for many months, and, sometimes, for several years. Subsidence of acute symptoms and of fever do not necessarily indicate that the disease has become chronic, especially in the presence of cellulitis. The sedimentation rate of erythrocytes seems to be the most accurate index of the degree of infection remaining in the pelvis.

Residual damage present when chronic stage is reached. When inflammation has passed the acute and subacute phases there may be a great variance in the amount of residual damage. The damage to tissue following acute gonorrheal salpingitis will depend to a large extent on the degree of inflammatory reaction and the extent of involvement. As has been stated, when the infection is mild and confined to the fallopian tube there may be complete recovery.

Usually, secondary invaders, streptococci, are responsible for extension of the inflammation to other pelvic structures, especially the cellular tissue. Postgestational or postoperative inflammation of the pelvis is caused chiefly by streptococci, which may remain viable in the tissue for many months.

In a large measure the extent of involvement and the symptoms resulting therefrom will determine the management of the condition. Roughly, 75 per cent of patients with acute gonorrhea will recover if treated conservatively, and about 80 per cent of patients with acute gonorrheal salpingitis will recover sufficiently so that operation is unnecessary.

Treatment. When a woman presents herself with chronic or subchronic pelvic inflammation, the method of treatment to be employed depends on the extent of the tissue involved, the presence or absence of localized collections of pus, and the patient's symptoms and disability.

The criteria to be considered are the disability, the discomfort, and the menstrual function of the patient. While correction of disability and relief of symptoms are evidently the most important, normal menstrual function should be preserved when it is humanly possible; the young woman unsexed may have health but unhappiness.

The majority of patients with chronic pelvic inflammation can be cured or greatly relieved by measures other than operation. These measures are based on three essentials: time, rest, and heat. Various methods have been used to bring heat to the affected areas. Diathermy is of value, but has not seemed to be so effective in bringing heat to the pelvic tissues as the Elliott vaginal heat method. In the Elliott method of treatment, a distensible rubber bag is inserted into the vagina and through it is circulated hot water under regulated conditions of heat and pressure.

Randall stated that proper distention of the bag is of primary importance, because the area of heat dissemination depends on a sufficient volume of water as well as the proper heat of the water. Proper distention of the bag may be noted on the gauge of the machine; and also, the palpating finger in the vagina or rectum can determine whether proper distention is obtained. In a recent paper, he and Krusen said that in observing more than 4,000 vaginal heat treatments at the Mayo clinic the average pressure employed was 2.2 pounds, and the average temperature 127° F.

In some cases of pelvic cellulitis the use of a rectal bag is more effective than the vaginal applicator. It is particularly of value when the vaginal application is impractical, the broad ligaments are fixed, or the lesion is beyond effective reach of the vaginal bag. The rectal bag is not used in gonorrheal infection.

In considering the results of treatment, cases of chronic infection reported by these authors were divided into two groups; proved gonorrheal infections, and infections of a non-specific nature. Forty-three patients with chronic gonorrheal infection were treated by the Elliott method and by topical applications to the urethra or cervix, or both. One hundred and seventy-three patients with chronic non-specific pelvic inflammatory disease were given the Elliott vaginal treatment.

In these groups, chronic parametritis or chronic cellulitis responded more slowly to treatment than chronic salpingo-ovaritis. The response of tubo-ovarian abscess was poor, and a large percentage of patients had to be operated on.

The effects of the use of sulphanilamide for this and other conditions indicate the necessity for care in administration because of occasional symptoms of lassitude or cyanosis, or the appearance of fever, hepatic enlargement, jaundice, sulphemoglobinemia, or evidence of destruction of erythrocytes. Saline cathartics are contra-indicated and apparently the drug is more effective if fluid intake is limited.

SURGICAL TREATMENT

Acute pelvic inflammations. Operative measures for acute pelvic inflammatory disease should consist only of drainage of collections of "pus" which point in such locations that destruction of tissue is unnecessary.

Chronic pelvic inflammations. Surgical treatment of chronic pelvic inflammation may be the method of choice for disabling pain or other symptoms resulting from damage to the tissues, when the condition has failed to respond to conservative measures carried out over an adequate period of time. Given an equal degree of pelvic disease, chronic discomfort, and disability in two patients, one of whom has means of support and the other of whom must earn her livelihood by physical work, operation might have to be done sooner in the latter case than in the former.

Operations may be done for the removal of irreparably damaged tissues producing disability, or in an attempt to restore normal function. Conservation of the menstrual function is desirable. Following complete subsidence of the original inflammation, operations may be necessary for the relief of symptoms in such cases, for instance, as adherent retroversion, adherent prolapsed ovaries, dyspareunia, intestinal obstruction, or sigmoid dysfunction causing painful defecation. The failure of some operations to relieve the symptoms of which the patient complains should make the surgeon cautious in performing operations on patients in whom sufficient tangible evidence for the symptoms is not revealed by careful search.

It is not within the scope of these remarks to outline the technique or methods of operation. It may be well to state, however, that operations for pelvic inflammatory disease are apparently made easier as a result of softening the adhesions and lines of cleavage in those cases in which the operation is performed after a course of fairly prolonged pelvic heat treatment.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Vignocchi, R.: Infraligamentary Extra-Uterine Pregnancy (Sulla gravidanza extrauterina infraligamentaria). *Riv. ital. di ginec.*, 1937, 20: 343.

The author presents a short review of the literature with special reference to infraligamentary ectopic pregnancy. This type of gestation is important because of the attachment of the placenta directly to the pelvic connective tissue. In this manner, it differs from some forms of intra-abdominal pregnancy in which the placenta is implanted in the tube.

Vignocchi records a report of a twenty-nine-year-old patient who had passed through a previous normal pregnancy and labor in 1927. Amenorrhea occurred again beginning March 27, 1936, and was soon followed by the subjective symptoms of pregnancy. At the end of May she visited a physician because of pain in the right iliac region accompanied by fever, vomiting, and some vertigo. After rest in bed for a few days she was well again except for a dull ache on the right side. Early in July there was a repetition of the symptoms with relief after rest. Her physician believed that she was suffering with a spastic colon. About the middle of July the patient believed that she felt fetal movements. On August 12 a slight discharge of blood from the vagina began and continued for fifteen days. About September 1 fetal movements stopped. She consulted the doctor about the middle of September because of the continued lack of fetal movements.

Physical examination revealed a somewhat tender abdomen in all portions. There was a mass projecting upward from the pelvis, especially on the right side, and reaching the umbilicus. It was rounded, firm, only slightly movable, and slightly tender. Otherwise the general findings were normal. Gynecological examination revealed the multiparous type of external genitalia without the characteristics of existing pregnancy. There was no bloody flow. The cervix and body of the uterus seemed normal. The left adnexa were normal. On the right side the mass, felt abdominally, seemed to be attached. The firm rounded structure felt like the head of a fetus.

At operation this mass was found to be somewhat adherent to the small intestines and omentum. These adhesions were freed and the entire mass, with the attached ovary, tube, and portion of the broad ligament was removed. The entire mass weighed 700 gm. The author gives a very detailed description of the gross and microscopic pathology of the specimen. The entire ovular cavity was contained between the leaves of the broad ligament, and the placenta was in contact with the loose connective tissue of the pelvis.

The development of such infraligamentary ectopic gestation is probably secondary to a ruptured tubal pregnancy which was situated precisely at the junction of the tube and the broad ligament.

A. Louis Rosi, M.D.

Keller, R., and Fournier, R.: The Different Forms of Premature Separation of the Normally Implanted Placenta from a Clinical and Therapeutic Point of View (Les différentes formes de décollements prématurés du placenta normalement inséré au point de vue clinique et thérapeutique). *Gynécologie*, 1937, 36: 449.

Uteroplacental apoplexy, according to the authors, is an anatomicoclinical syndrome which manifests itself clinically by the abrupt appearance of uteroplacental hemorrhage and disturbed uterine contractility. The salient characteristics are the anatomical lesions involving the uterus and its adnexa. The symptomatology, on the other hand, is by no means so definite and does not differ greatly whether uterine lesions are present or whether the case involves merely retroplacental hemorrhage. Therefore, the diagnosis of uteroplacental apoplexy can be made with certainty only when surgical treatment (cesarean section or hysterectomy) is instituted.

The authors discuss the different views concerning the pathogenesis of uteroplacental apoplexy: trauma, toxemia, and endometritis. They insist that classifications of these cases should be based not upon such supposed causes, but rather upon clinical severity. Accordingly, they have grouped their series of 27 cases, occurring in their service over a period of seventeen years with an incidence of 1.06 per cent, in the following categories: (1) mild types, and (2) severe types. The latter group is divided into cases which are serious because of hemorrhage, and those which are serious because of associated toxemia (eclampsia and pre-eclampsia). The total mortality in their series was: maternal, 11.1 per cent, and fetal, 81.5 per cent. The entire maternal mortality occurred in the severe types. The authors give detailed accounts, with appended case reports, of the various therapeutic procedures carried out and the clinical features noted in the different groups outlined above.

Of particular interest in this discussion are the views presented by the authors in summarizing their experiences:

1. Hemorrhage is the outstanding clinical finding in premature placental separation. It is most often the first clinical indication of this disorder. In mild types the bleeding is difficult to distinguish from that seen in placenta previa. Two-thirds of their patients showed external bleeding as the initial symptom. Moreover, they noted that severe external bleeding was seldom associated with toxic signs, and *vice versa*. Board-like rigidity of the uterus, contrary to general opinion, is not a constant

finding; it was present in only one-half of the patients, regardless of the grade of severity or extent of the hemorrhage.

2. Contraction of the uterus, contrary also to common opinion, is not unusually painful. Sensitivity of the uterus to palpation, on the other hand, is almost certain evidence of uteroplacental apoplexy. This symptom merits greater attention in their opinion, and is of value in dictating the choice of treatment.

3. Associated signs of toxemia (hypertension, albuminuria) are not signs of abruptio placentæ *per se* but rather signs of pregnancy toxemia, which frequently accompanies this condition. The fact that abruptio is rare while toxemia is frequent makes the authors inclined to deny a causal relationship between these states, certainly as far as the hypertensive factor is concerned.

In summarizing their therapeutic views the authors state a strong case for conservative, i.e., non-surgical, methods. In mild types, normal vaginal delivery is always possible. Vaginal hysterotomy is indicated in exceptional cases when dilatation is slow. Fetal indications alone will occasionally justify more rapid methods of vaginal delivery. Abdominal delivery for the sake of the child, as in elderly primiparas, is justifiable if the added risk to the mother is desired or if some additional complication, such as contracted pelvis, makes successful vaginal delivery doubtful. The uterus should be retained if it contracts well, which, in the opinion of the authors, is almost always the case.

In severe varieties, menaced by profuse hemorrhage or toxemia, or both, no fixed line of treatment can be laid down. When hemorrhage is the predominating feature, rupture of the membranes generally stops bleeding and expedites labor. Once stopped, hemorrhage rarely recurs during labor. Delivery by low forceps and breech extraction is justified as soon as dilatation is complete. The postpartum danger is chiefly atonic bleeding, rather than toxic absorption from the Couvelaire uterus claimed by Riviere. Oxytocic drugs should be used freely. The authors, in instances of post-partum bleeding, earnestly commend manual revision of the uterus. Removal of blood clots aids in stimulating contractions and frees the uterus of potential sites for infection. As a final resort, tamponade can be relied upon for good results. This mode of treatment has given the authors better results than have surgical methods.

When toxemia other than eclampsia complicates the hemorrhage, the choice of therapy is difficult. Abdominal delivery is justified if the patient is seen early, if the fetus is alive and viable, if the symptoms are rapidly progressive, and if labor does not begin. Expectancy, on the other hand, gives excellent results in these cases, particularly with the help of blood transfusions. Even these severe types have responded better to conservative measures in the authors' experience.

When eclampsia is associated, the authors consider uteroplacental apoplexy the lesser of the two evils. Treatment in such instances is directed toward the eclampsia with pernocton given intravenously by the Stroganoff method. Methods to hasten delivery may be employed secondarily. The authors indicate their complete satisfaction with this form of therapy. Surgical treatment would be unthinkable in such cases.

Generally speaking, the uterus in all varieties of cases of apoplexy contracts well. The danger of toxic resorption from an apoplectic uterus is denied by the authors. Hysterectomy may be indicated under rare conditions when: (1) infiltration and edema of the uterus and peritoneum are very extensive, (2) when atony persists despite oxytocic measures, (3) when there is severe toxemia, and (4) as a last resort in uncontrollable post-partum bleeding, a condition which the authors have never observed. Criteria for hysterectomy advanced by other authors would have necessitated the needless sacrifice of the uterus in 5 of their cases which were delivered successfully by means of conservative measures.

Follow-up studies on their patients delivered by obstetrical methods showed 16 subsequent pregnancies with 13 terminating successfully at term. Premature separation of the placenta did not occur in any of the ensuing pregnancies.

HAROLD C. MACK, M.D.

LABOR AND ITS COMPLICATIONS

Bruecke, H. von: High-Forceps Operations (Ueber hohe Zangenoperationen). *Arch. f. Gynaek.*, 1937, 164: 42.

The author reports on 34 high-forceps operations carried out among a total of 18,611 deliveries at the Graz University Women's Clinic in a period of nearly ten years. In this period forceps were used in 2.01 per cent of all deliveries, and the high-forceps operation in 0.18 per cent. Emphasis is laid on the importance of a suitable preparation of the soft parts by a sufficiently large vaginoperineal incision, and, if need be, by hysterostomatomy. The Viennese School forceps was used in 24 of the 34 cases; the Kielland forceps in 10. There was no maternal death in the series. In 5 cases there were extensive tears of the vagina and perineum. In 2 cases there was injury to the bladder: one case of pressure necrosis, and one case of tear of the bladder. In both of these cases the fistulas healed spontaneously.

The anterior spoon of the Kielland forceps was usually rotated in accordance with the original instructions of Kielland. Sometimes it was held loosely and allowed to take its own course. In a few cases Bruecke applied the anterior spoon directly, and in one of these cases the hand of the child slipped through the window in the forceps and prevented extraction. The child died and perforation had to be done. This case, however, is not included in this series.

Fourteen of the 34 children died; 11 of the deaths were due to injury to the skull or cervical spine. The child is particularly endangered in cases of contracted pelvis. In the great majority of the cases of death of the child it was the Viennese School forceps that was used. The high forceps operation is an emergency measure, which in certain rare cases has justified itself. For improvement of the results it is particularly important that careful consideration be paid to the presence of contracted pelvis. From a technical standpoint the Kielland forceps has shown itself indubitably superior to the Viennese School forceps.

(HANS HEIDLER). FLORENCE A. CARPENTER.

Erbsloeh, J.: Unsuccessful Attempts at Forceps Delivery In and Outside of the Clinic (Ueber den vergeblichen Zangenversuch inner- und ausserhalb der Klinik). *Monatsschr. f. Geburtsh. u. Gynaek.*, 1937, 105: 257.

The author reports 48 cases of unsuccessful forceps delivery observed over a period of ten years in the course of 20,000 deliveries. In 33 instances forceps delivery had been attempted at the home of the patient prior to her admission to the hospital. It is noteworthy that there were only 18 primiparas as compared to 15 multiparas in the group.

It was also observed that forceps attempts failed much more frequently the earlier in the course of labor the attempt was made. Forceps failure is rare when the head is on the pelvic floor, also when the head is in the mid-pelvis; failures occur most often when the head is still movable.

The author discusses a series of cases with faulty diagnoses and hence improper indications. The results of high forceps deliveries were extremely poor for both mother and child. In many instances, oxytocic drugs were used without reason and repeatedly; 6 fetal deaths are attributed to this cause.

Cases of unsuccessful forceps delivery which occur in the hospital, i.e., high forceps deliveries, are always cases in which cesarean section is contraindicated; hence, a high fetal mortality (60 per cent) is always to be expected.

(E. ZWEIFEL). HAROLD C. MACK, M.D.

PUERPERIUM AND ITS COMPLICATIONS

Block, E.: Manual Detachment of the Placenta and Intra-Uterine Post-Partum Revision: A Clinicostatistical Study (Ueber manuelle Loesung der Placenta und intrauterine Revision post partum: Eine klinisch-statistische Studie). *Acta obst. et gynec. Scand.*, 1937, 17: 342.

Opinions are about equally divided as to the dangers of and certain indications for manual detachment of the placenta. Among 50,545 deliveries at the Gothenburg Maternity Hospital, the cases of manual detachment of the placenta amounted to 0.76 per cent. The figures in the literature vary between 0.51 and 3.25 per cent.

Among 386 cases of manual detachment of the placenta or its remains, there were 14 (3.6 per cent) primary fatalities. Six fatalities resulted from hemorrhage and may be deducted. In the remaining 8 cases the cause of death was infection, but in no case could a genital origin be excluded. The corrected mortality was 2.1 per cent. Of these 8 fatalities from infection, 6 were due to puerperal sepsis; the remainder were due to pneumonia and pulmonary embolism, probably not of genital origin. This brings the mortality down to 1.6 per cent. Only in 2 cases could the fatality be definitely attributed to manual detachment. This gives an adequate estimate of the danger associated with intra-uterine manipulations after delivery.

In the literature, the morbidity figures vary between 20 and 80 per cent, because some authors cite the total morbidity, and others the corrected morbidity. Under "corrected morbidity" are included: (1) septic cases, in which a genital source of infection cannot be excluded; (2) cases of thrombosis; and (3) cases of resorption fever during the puerperium. The author also includes non-acute cases of hemorrhage, urinary tract infection, and infection of the upper respiratory tract and breasts. Of the 386 cases, 130 showed complications in the puerperium, a total morbidity of 33.7 per cent. In the corrected mortality of 25.4 per cent, 32 cases were not included. There is a distinct tendency toward an increased frequency of genital puerperal infections.

In this series of 386 cases of manual detachment of the placenta, the entire placenta was removed in 267 cases, and placental remains were removed in 119. It was found that the detachment of the entire placenta is associated with a much greater danger of puerperal complications than detachment of placental remains. All of the fatalities occurred in the former group. The corrected mortality amounted to 2.6 per cent. Manual separation of the placenta is not a relatively innocent intervention; however, after manual detachment of placental remains the mortality is nil and the morbidity is 11.8 per cent; the latter is therefore a fairly harmless intervention.

An absolute indication for the earliest possible removal of the retained placenta is the amount of blood lost, regardless of the time since the delivery. The removal should be done prophylactically and not after a marked loss of blood. Late interventions contribute to the high mortality formerly seen. With a loss of 500 c.cm. of blood, manual removal of the placenta is to be considered. In cases of placental retention without serious blood loss (less than 500 c.cm.) the time of intervention is still under dispute; after about two hours is considered the proper time. In infected cases, the removal should be done earlier. Other measures should be tried before resorting to manual removal. The author classifies the cases of hemorrhage into two groups: (1) those with a loss of 500 c.cm. of blood or more, and (2) those with a loss of less than 500 c.cm. With placental retention in the first group, the blood loss greatly increases the danger of serious complications; there-

fore prophylactic therapy is of great importance. The blood loss should be measured. This applies particularly to infected cases. In the second group, the time of intervention is of no serious import in clean cases. In these the danger of serious puerperal complications is slight in spontaneous deliveries, but not insignificant after operations for delivery, and reserve is indicated for manual intervention. Infected cases do not demand the earliest possible manual removal.

In clean cases the morbidity and mortality were 29.1 and 2.4 per cent, respectively; in infected cases, the morbidity was 75.9 per cent and the mortality 6.9 per cent. These figures show a considerably worse prognosis for infected cases. The danger of complications from manual displacement after delivery operations is considerably greater than after spontaneous deliveries.

The author divides the cases of delivery operations into two groups: (1) those with placental retention in which the usual lines of therapy were followed, and (2) those in which the placenta was removed immediately after delivery. In none of the cases in the second group were there any serious puerperal complications. Most of the complications occurred in the first group, in which weak labor pains were the indication for operative intervention. Placental expression procedures should be done before resorting to manual removal, unless a hemorrhage threatening life makes immediate intervention necessary.

With Credé placental expression under anesthesia, there were failures in 99 cases and successful results in 27 cases (21.4 per cent). This procedure was done successfully in 17.6 per cent of the operative cases and in 22.8 per cent of the normal deliveries. Placental expression is usually a harmless procedure, but may be dangerous in cases with severe hemorrhage in which delay might be serious, in cases with placental remains resulting in loss of an amount of blood threatening to life, in infection, and in uterine neoplasm formation, such as a placental polyp or chorionepithelioma. With intra-uterine exploration early and before the loss of blood has become too great, there is only a slight danger of puerperal complications from placental remains Intra-uterine explorations were done only in 5 (18.5 per cent) of 27 expressions under anesthesia. The dangers are the same even without anesthesia.

In all of the 119 cases of retained placental remains cited, the intra-uterine revision was done shortly after delivery, either because a developing hemorrhage suggested that there were placental remains in the uterus or because the placenta was found defective. The results were the same as with manual displacement of the entire placenta. Bleeding cases show a higher morbidity than non-bleeding cases and operative cases a higher morbidity than spontaneous deliveries. LOUIS NEUWELT, M.D.

NEWBORN

Harrar, J. A.: Worth-While Surgery in the Newborn. *Am. J. Obst. & Gynec.*, 1937, 34: 661.

Certain children are born with developmental somatic abnormalities and others with birth trauma. Many of these conditions are, of course, incompatible with survival, and some which are temporarily amenable to operative treatment subsequently prove to be virtually hopeless. However, in certain deformities and injuries, promptly performed operation is imperative and life-saving, while in certain other conditions treatment could and should be initiated by the obstetrician during the neonatal period.

The author's conclusions are as follows:

1. Operations are of value in imperforate anus, amniotic hernia and hernia into the cord, supernumerary digits, phimosis, and tongue-tie.

2. Early treatment is important in brachial birth palsy, fracture of the long bones, depression of the skull, forceps-blade pressure marks, and the deformity of talipes or clubfoot.

3. Operations are unnecessary in cephalhematoma and engorged breasts.

4. Both operation and treatment are indicated later in undescended testicle, harelip and cleft palate, hydrocele and inguinal hernia, pyloric spasm or stenosis, and exstrophy of the bladder.

5. Operations are practically useless in spina bifida and tracheo-esophageal fistula.

EDWARD L. CORNELL, M.D.

GENITO-URINARY SURGERY

GENITAL ORGANS

Plaggemeyer, H. W., and Weltman, C. G.: The Limitations of Transurethral Resection of the Prostate Gland. *J. Urol.*, 1937, 38: 389.

The author reviews the work of early resectionists and emphasizes the need for the evaluation of each case. He urges the use of a large caliber resectoscope only until enough tissue is removed that the smaller sheath may be introduced and manipulated. He states that rapid work and the absence of trauma are cardinal points in operative technique, and lists the following factors as probable contra-indications: (1) large extravesical prostates, (2) large intravesical prostates extending backward under the trigone in an embarrassing proximity to the ureteral orifice, (3) deeply imbedded prostatic calculi, (4) large vesical calculi, with a foully infected bladder, (5) dependent diverticula of the bladder, (6) patients in the early fifties, with a mild, diffuse infection, and with possible beginning adenoma, and (7) cases with an improper chloride output. The limitations of the operation lie within the limitations of the man behind the resectoscope. DONALD K. HIBBS, M.D.

Turner, G. G.: Imperfect Migration of the Testicle: The Surgical Problem. *Proc. Roy. Soc. Med.*, Lond., 1937, 30: 1319.

The author discusses the pre-operative consideration of the patient as well as his technique and results. He divides the cases of bilateral undescended testicles into two groups, namely, those which apparently lack an endocrine stimulus, and those in which mechanical assistance may supplement or even replace the former. He believes that symptoms attributed to the undescended testicle are often exaggerated, but an undescended testicle is more liable to torsion than the normally placed organ. He believes in giving hormonal treatment a twelve-month trial period. Unilateral cases as a rule are an easier problem either for orchiopexy or castration. The essential part of the operative technique is the thorough mobilization of the cord above the internal ring. As a rule, the author fixes the implanted testicle to the thigh for from three to six months. DONALD K. HIBBS, M.D.

Henry, S. A.: The Study of Fatal Cases of Cancer of the Scrotum from 1911 to 1935 in Relation to Occupation, with Special Reference to Chimney Sweeping and Cotton Mule Spinning. *Am. J. Cancer*, 1937, 31: 28.

The author makes a further study of the relation of cancer of the scrotum to occupation, with special reference to confirmation or correction of the pathological nature of the primary site of the growth, and the nature of the occupation of each of 1,487 males who died of the disease between 1911 and 1935.

In the majority of cases the occupation given on the death certificate is probably the important one and frequently suggests a cause for the disease, such as mineral oil, soot, tar, or pitch in the case of cotton mule spinners, chimney sweeps, tar workers, and patent fuel workers, respectively; however, there are certain cases in which the occupation stated gives no such indication. A subsequent investigation of a number of the latter has revealed the fact that the occupation mentioned was only a recent one, and has elicited a history of earlier employment of many years' duration in which there was contact with a known carcinogenic agent.

The number of fatal cases recorded as cancer of the scrotum by the Registrar General for England and Wales between 1911 and 1935 is 1,487, the disease being defined as epithelioma in 903 cases, carcinoma in 362, cancer in 206, rodent ulcer in 3, sarcoma in 12, and teratoma in 1 case. The figure does not include 94 cases of malignant disease of the "penis and scrotum," which are recorded under cancer of the penis by the Registrar General, but includes 22 cases of malignant disease of the "scrotum and penis." However, investigation of some of both sets of cases suggests that the site first stated may not invariably be the primary one. Neither are there included 35 cases of malignant disease of the "genitals," which are recorded under cancer of the penis, or 131 cases of cancer of the inguinal or iliac lymph nodes.

The tabulation summarizes the comparative results of the present study of fatal cases of cancer of the scrotum and of other cutaneous sites in chimney sweeps and cotton mule spinners. In chimney sweeps there is a slight reduction in the actual number of fatal cases of cancer of the scrotum between the first and last quinquennial periods, but the number of sweeps at risk is equivalently reduced. There is an increase in the number of fatal cases of cutaneous cancer at other sites than the scrotum, but the figures for all cutaneous cases are the same in the first as in the last quinquennial period. The crude death rate for cancer of the scrotum for the number of sweeps at risk is 620 per 1,000,000, and was the same for the first as it was for the last quinquennial period; it is now 98.4 times higher than that for the general population.

In cotton mule spinners there is a marked increase in the number of fatal cases of cancer of the scrotum, from 40 in the first quinquennial period to 92 in the fourth quinquennial period, falling to 80 in the fifth quinquennial period, though the number was still double that in the first. There has been an increase in the number of fatal cases of cancer on cutaneous sites other than the scrotum, but this increase is less marked than that for cancer of the scrotum. The crude death rate for cancer of the scrotum for the number of cotton mule spinners at risk was at least 190 per 1,000,000 in the first and at least 480 per

1,000,000 in the last quinquennial period, and is now at least 76.2 times higher than that for the general population.

Cotton mule spinning has arrived at a very interesting period, approximately eighty-six years after the possible or at any rate limited introduction of a certain carcinogenic agent into the trade, or more probably over sixty years after its extensive introduction. It must be noted that, for reasons which did not include prevention of the disease, a gradual change from a potent carcinogenic agent to one less potent may have been introduced many years ago, at least in certain mills or certain districts, and this, while complicating the study, may offer one explanation of certain facts which at present are not clear, as for instance why the annual number of cases would appear to have commenced to decrease.

It is of importance to go into minute detail and avoid surmise not only in dealing with experiments on animals, but also in observing the results of certain carcinogenic agents in man, for some sixty or eighty years in the case of cotton mule spinners, and for a much longer period in the case of chimney sweeps.

In dealing with the effect of a carcinogenic agent on the human being, one must bear in mind that if certain individuals, while not completely resistant, yet are capable of resisting a particular carcinogenic agent for sixty or seventy years after the first date of contact with it, even though its application has ceased for some time, such individuals cannot be expected to show signs of the disease until well over the age of sixty, seventy, or eighty. Even then they may never appear on the cancer death list if treatment is early and successful, or may appear on it only years later when treatment for a second or subsequent primary growth has proved unsuccessful. Early treatment may also be successful in patients with an early manifestation of the disease.

Any preventive measures which have been or will be taken, with reference to the methods of use or removal of any carcinogenic agent concerned, should materially reduce the incidence of the disease; however, these must not be expected to produce an immediate dramatic decrease, for it is now clear that even if contact with the causal agent ceases, the disease, unfortunately, may manifest itself in years to come, provided the period of contact has already been sufficiently substantial. Hence, although the earlier the precautionary measures are taken the sooner will the result eventually become evident, the benefits will accrue to a future generation in industry rather than to those who have already been employed for some years.

Finally, while the result of this survey of a fatal disease presents points of interest, it is of greater practical importance, when preventive measures are being considered, to know the time which a carcinogenic agent is taking to produce an outward manifestation of the disease in man. Information regarding this cannot be deduced with any accuracy from the age of death when the duration of employment is unknown and when the fatal termination of the disease may occur only long after the primary manifestation of the growth.

C. Travers Stepita, M.D.

MISCELLANEOUS

Walther, H. W. R.: Urinary Antisepsis. *J. Am. M. Ass.*, 1937, 109: 999.

An ideal urinary antiseptic for internal use has not yet been found. Recent investigations of a more scientific nature, however, should convince many skeptics of the need for these agents in urological therapy. These studies reëmphasize the dangers of an indiscriminate use of a single drug for all types of infections in the urinary tract.

From a clinical point of view, four effects have been attributed to oil of santal: an inhibitory effect on the secretion, a relief of spasm, a sedative effect, and a diuretic action. The Council on Pharmacy and Chemistry of the American Medical Association, in its 1936 edition of "Useful Drugs," recognizes oil of santal, but recommends the restriction of its use in gonorrhea to the subacute and chronic stages, in which its irritant action may stimulate healing. Although less popular than formerly, oil of santal and the other related volatile oils still have a place in urinary antisepsis.

Hinman, in evaluating methenamine, called it the most efficient urinary antiseptic in the greatest number of cases, but drew attention to its very definite limitations. The value of methenamine for kidney antisepsis is largely destroyed by the necessity for concentration and for time to permit accumulation of formaldehyde in antiseptic amount. The same is true for cystitis unless retention is present. Edwin Davis in 1932 stated that methenamine is incomparably more efficient than either pyridium or hexylresorcinol in causing the normal person to secrete urine that is antiseptic against both the colon bacillus and the staphylococcus. In 1937 he had not changed his opinion. In answer to a recent questionnaire he states: "With respect to methenamine, I am forced to the conclusion that this is a valuable remedy, the merits of which we have tended to overlook in our search for something newer and better." He writes that it has been demonstrated that the administration of methenamine, together with ammonium nitrate or chloride, imparts an antiseptic value to the urine with amazing consistency—an observation that he has been able to verify with subsequent checks. Helmholz warned in 1932 that treatment with methenamine without constant control of the hydrogen-ion concentration is likely to be unsuccessful. He found as the result of experiments that at a pH of 6, urine with a 0.5 per cent concentration of methenamine rarely sterilizes itself at the end of twenty-four hours. At a pH of 5, urine can be sterile after four hours at 37° C.

Methylene blue became very popular during the last decade of the nineteenth century, when it was turned to good account in gonococcic infections. It also found a peculiar application in tuberculous con-

ditions of the urinary tract. Thomas and Wang think that methylene blue is not so inert as many hold it to be; they state that they have found it to be bactericidal even in comparatively high dilution. They emphasize, nevertheless, its irritating effect on both the digestive and the urinary systems.

The first experimental work with acriflavine was done by Browning and Gulbransen in 1917. Their work was concerned with intravenous injections of this dye, and was undertaken with a view to conferring bactericidal properties on the blood. They then found also that if acriflavine was administered by way of the alimentary system it was absorbed, and that in either case the urine soon exhibited the canary yellow fluorescence that is so characteristic of acridine compounds. Edwin Davis substituted neutral acriflavine for the original flavine, the substituted drug being neutral in reaction and capable of being used in higher concentrations. Its antiseptic action begins within two hours after oral administration and lasts for at least eight hours. Unlike most of the other urinary antiseptics, its action is more pronounced when the urine is alkaline. In the author's clinic, it has not been of any real value in gonorrhea, but it has helped to clear up the urine in renal and vesical infections in about 50 per cent of the cases. In nearly all cases there were disagreeable gastro-intestinal disturbances if treatment was kept up for any length of time, and this was equally true when sodium bicarbonate was administered with it.

Regarding pyridium and azo dye therapy, the author states that on the whole these dyes have been found to be a most valuable adjunct in the majority of the cases in which they were used; but that sometimes they failed utterly, and proved the truth that there is no single bactericide that will destroy all bacteria in the urinary tract. He found their sphere of usefulness a wide one, because of the fact that they work equally well in an acid and an alkaline medium. They require no special dietary regimen. About 33 per cent of answers received to a questionnaire stated that pyridium and the rest of the azo dyes seemed to be of no material benefit; 46 per cent stated that they were definitely of value; 21 per cent had never tried them. All in all, however, it would appear that these substances constitute valuable stepping stones in the path of progressive urological therapy.

The chief sponsor for hexylresorcinol (a product of synthetic chemistry) was Veader Leonard, who gave a minute description of its properties in 1924. According to his statement, it meets all the experimental qualities enumerated by Davis as essential to the ideal urinary antiseptic in the following manner: it is chemically stable, non-toxic in therapeutic doses, non-irritating to the urinary tract, bactericidal in high dilution in urine of any reaction, and is excreted by the kidneys unchanged and in sufficient percentage to impart active bactericidal properties to the urine. Results obtained by Leonard up to the date of his writing seemed to justify the claim that in chronic infections of the urinary tract in adults which are due to staphylococcus albus and aureus and some strains of bacillus pyocyaneus, oral administration of hexylresorcinol without any other treatment has resulted in prompt and complete disinfection of the urinary tract, accompanied by clearing up of the urine and disappearance of symptoms. In colon-bacillus infections, more persistent treatment is usually necessary and, as a rule, local treatment will be found necessary, as well as intensive courses of the drug. There was, according to Leonard, increasing evidence that in cases in which this complete disinfection of the urinary tract did not occur, pyelonephritis was present.

Five and a half years ago Clark, and also Helmholz, working independently, tried for the first time the effect of acidification of the urine by feeding a special type of high fat, low carbohydrate diet, designed to produce a state of ketosis. The ketogenic diet in its original form was very elaborate and was so exacting in the precision of its minutest details that it was quite unsuited for practical use at home. It had, therefore, the disadvantage of requiring hospitalization of patients who were otherwise not in need of hospital care. On account of the marked gastro-intestinal disturbances caused by the ketogenic diet, it became increasingly difficult to persuade patients to take it. In view of the larger percentage of elderly patients with urosepsis and with established gastro-intestinal disorders, the problem was far from being solved by the ketogenic diet which seemed at best a clumsy, roundabout way of producing a high degree of acidity that might be achieved in some other way. Attempts to find this better way, therefore, were continued.

Two years ago Rosenheim announced his discovery that mandelic acid would do in a direct way what had been done in an indirect and complicated way with beta-hydroxybutyric acid and the ketogenic diet. He recommended that it be given in the form of a salt, such as sodium or ammonium mandelate. This treatment has a tremendous advantage over the ketogenic diet in that the patient may eat whatever he likes, and it has achieved very wide usage because of its incontestable bactericidal potency. In placing mandelic acid in the hands of the medical profession, Rosenheim postulated that its use was effective only in cases unassociated with urinary obstruction.

Helmholz recently made observations with sulphanilamide which demonstrate that urine of patients taking the drug develops definite bactericidal power for such organisms as are commonly found in infections of the urinary tract. Dees and Colston were the first to record their experiences with sulphanilamide in the treatment of gonococcic infections. In 19 cases observed, the smears and urines became negative for gonococci in two days in 5 cases, in three days in 5 cases, in five days in 2 cases, and in four, six, and twenty-three days, respectively, in single cases. All patients received, in 4 divided doses a day, 4.8 gm. of sulphanilamide daily for two days,

3.6 gm. daily for three days, and then 2.4 gm. daily for from four to eight days. These authors warn against a continuance of the drug immediately on complaint by the patient of headache, fever, lassitude, cyanosis, general malaise, or extreme weakness. The author warns against so large an initial dose of this new drug as routine, since disagreeable and, at times, serious reactions may follow such a plan. He considers it far safer to begin by giving 1.2 gm. daily for the first two days, and if this is well tolerated, increase the dose to 2.4 gm. daily for two days. Beginning with the fourth day, provided sulphanilamide is still being taken without untoward effects, the drug then can be gradually increased daily until 4.8 gm. is reached. Provided adequate care is exercised, this drug will occupy an important niche in armamentarium for combating the various strains of coccic invasion.

None of the present known urinary antiseptics can be called specifics. Every new agent announced should be given its day in court; it should have a fair trial, after which it will, as Davis has pertinently said, reach stability at its proper level of usefulness.

C. Travers Stepita, M.D.

Habein, H. C., and Mulrooney, R. E.: The Relation of Water, Sodium Chloride, and Acid-Base Balance to Renal Function in the Treatment of Lesions of the Urinary Tract. *Am. J. Surg.*, 1937, 38: 6.

The preservation and maintenance of adequate renal function is one of the most important considerations in the management of patients with lesions of the urinary tract. Functional disorders of the kidney associated with diseases of the urinary tract, which are often called "surgical" diseases of the kidney, differ from so-called medical nephritis with regard to origin, pathology, treatment, and prognosis. Hypertension and arteriosclerosis are not directly related to surgical diseases of the kidney as is so often the case in glomerular nephritis.

Alterations in various components of the blood plasma may seriously affect renal function and retard its improvement. A knowledge of the physiological mechanism of renal function is essential.

The maintenance of a proper water balance is one of the most important factors in aiding the kidney to carry out its complete function, and the modern intravenous use of fluids is one of the significant advances in medicine. That this method of supplying fluids parenterally is at times a life-saving measure cannot be doubted. However, there does not seem to be a uniformity of opinion at the present time regarding the amount and composition of the solutions to be used intravenously in the various conditions.

Edema is not a common complication in surgical diseases of the kidney, but it may develop as the result of the excessive intake of fluids, especially saline solution. The intravenous use of 5 per cent dextrose solution is probably preferable when fluids are to be given parenterally, unless there is a specific indication for other types of fluid.

The extrarenal causes of renal insufficiency, such as the toxemia associated with prolonged vomiting and obstructive lesions in the upper part of the gastro-intestinal tract play an important rôle in the treatment of patients suffering from postoperative complications.

Lowering of the plasma proteins may occasionally, when associated with malnutrition, anorexia, and suppurative drainage, be one of the factors in the production of edema.

The acid-base regulation of the blood plasma is an important factor in the maintenance or improvement of renal function. One of the non-excretory functions of the kidney is the manufacture of ammonia. This mechanism is disturbed in renal insufficiency and produces acidosis. The treatment of acidosis associated with renal insufficiency by the intravenous use of alkalies, sodium lactate, and Hartmann's solution is discussed.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Compere, E. L., and Adams, C. O.: Studies of Longitudinal Growth of Long Bones. I. The Influence of Trauma to the Diaphysis. *J. Bone & Joint Surg.*, 1937, 19: 922.

The writer and his associates present this paper as the first of a series of studies directed toward a better understanding of the physiological processes regulating the rate and extent of long-bone growth. That certain factors, such as disease, trauma, or glandular dysfunction, may alter such growth is well known but investigators do not agree in their attempts to explain: (1) why overgrowth of a long bone of a child occasionally occurs after fracture of the shaft; (2) why the epiphyses fuse to the shaft with complete cessation of longitudinal growth shortly after puberty; (3) what insults to the bones will consistently stimulate, retard, or arrest longitudinal growth; (4) what deformities may be predicted following insult to the growing epiphyses; (5) how the epiphyses, themselves, grow; (6) through what biological mechanism acute or chronic systemic infections may alter the longitudinal growth of bone; (7) the relation between delayed puberty and delayed closure of epiphyseal lines of long bones; (8) the effect on rate or extent of longitudinal growth of bone or interruption of blood supply to the shaft, the metaphysis, or the epiphysis; (9) whether it is possible for the epiphysis, once destroyed, to regenerate and to function as a growth center; and (10) why all long bones are preformed in cartilage and only a few bones of the head and face are formed in membrane.

Ollier first noted that irritation of the shaft of a bone could cause increase in the rate of growth and that it might produce overgrowth of as much as one-fifteenth of the total length of the bone. This study has been carried on further by others, including Kishikawa, Ferguson, and Lambert.

The authors' investigations were based on experiments with rabbits. In the first experiment the femurs of 6 rabbits were injured with minimal damage to the soft tissues. It was found that trauma sufficient to interrupt the medullary blood supply but not great enough to cause a regional hyperemia during the period of bone repair will not consistently cause growth stimulation and overgrowth.

Further experiments revealed that gross trauma, involving a considerable portion of the shaft of a long bone and necessitating extensive repair over a long period of time, produces epiphyseal stimulation and longitudinal overgrowth, the increased rate of growth continuing only during the period of healing. This longitudinal overgrowth of bone following fracture of the shaft occurs entirely from stimulation of the epiphyseal growth cartilage and not from the diaphysis or the cartilaginous callus which forms at the site of the fracture.

The longitudinal overgrowth which may accompany a fracture occurs regardless of whether or not there is initial shortening as a result of overriding or loss of shaft substance. This observation, together with the fact that overgrowth may occur also after gross trauma without loss of continuity of the shaft of a bone, such as excision of a full-thickness tibial bone graft, is further evidence to support the theory that local hyperemia is the basic stimulus and that it is not a compensatory phenomenon.

Chronic localized inflammation of the diaphysis due to an irritant foreign body may result in marked bone proliferation with an increase in the diameter of the shaft. There is some evidence that under these circumstances localized interstitial longitudinal growth may occur. This possibility is deserving of further investigation. RUDOLPH S. REICH, M.D.

May, H.: The Regeneration of Bone Transplants. *Ann. Surg.*, 1937, 106: 441.

Experiments were undertaken in which whole radii of dogs were taken out by opening the joint capsules and subperiosteal dissection, and the bones were reimplanted in their original location. The periosteum, which had not been separated from the surrounding tissues, was sutured over the bone and the joint capsules were closed. Four of the operations were successful and were not complicated by infection. The animals were killed five weeks, ten weeks, four months, and ten months postoperatively. The involved limb was injected with radiopaque material through the axillary artery and the radius roentgenographed after removal from its periosteum.

The revascularization thus illustrated was divisible into three stages. In the first stage (after five weeks) numerous small vessels coming from the periosteum penetrated the cortex. The second stage or transformation (after ten weeks and four months) showed replacement of this fine vascular network by a few larger vessels. This process was completed during the stage of functional adaptation of the bone (after ten months). On histological examination, it was found that after only five weeks the entire graft was necrotic except for the marrow in a few regions, notably adjacent to the articular and epiphyseal plate cartilages, where active myeloid cells were abundant. In animals killed ten weeks and four months postoperatively the bone was being transformed into living bone, apparently by creeping substitution. In the animal examined ten months postoperatively the entire graft was viable. No evidence of osteoclasis was found in cortical bone covered by periosteum, but in a few places where periosteum had been destroyed, incident to the operative procedure, the underlying bone exhibited osteoclasis by osteoclasts, fibrous tissue pene-

trating the haversian canals. In these regions some new bone formation was also present, some having been laid down generally by the periosteum.

The author concludes that in patients quick vascularization of the grafts is essential if the graft is to be ideally revascularized. Hemorrhage should be strictly controlled at the grafted site and all dense fibrous tissue in the region should be carefully removed. Moreover, since the bone of the graft originally becomes necrotic and is only gradually returned to life during later stages of the transformation, absolute immobilization of the operated bone is essential for ideal healing. The author states that bone grafts are usually largely revascularized and alive in from eight to ten weeks in the absence of infection. At this period, as demonstrated by roentgenograms, he partially removes the dressings and begins physical therapy. Various types of grafts and controversial literature on the fate of bone grafts are discussed. ROBERT PORTIS, M.D.

Vavrda, J.: Shoulder Pains (Schulterschmerzen). *Bratislav. lek. Listy*, 1937, 17: 186, 215.

The author considers all morbid conditions of the shoulder joint and its surroundings under shoulder pains. Anatomical relations of the joint and its surroundings, especially of the numerous bursæ, are emphasized. In every case he determines exactly whether the difficulty in question is in the joint itself or in the neighboring parts. The changes which follow accidents, infections, rheumatic and climacteric conditions, neuritis, sarcoma, osteitis fibrosa, syphilis, tuberculosis, gonorrhea, lead poisoning, trichinosis, and, finally, periarthritis of the scapulohumeral joint are all considered and their treatment is discussed. Pain in the shoulder is considered the expression of manifold states of disease, just as sacral pain or headache. The shoulder has the advantage over most of the other joints, in that several diseased states which heal through rest soon fix the joint itself, as tuberculosis. In considering shoulder pain one must immediately distinguish which part really hurts; whether it is the shoulder joint itself, the acromioclavicular joint, or the tissue in the immediate neighborhood, such as the bursæ or muscles.

The author distinguishes four different classes of shoulder pain:

1. Pain which follows accidents.

2. Pain which is projected from an outside source, which has nothing to do with the joint. This pain in the shoulder can indeed be a worth while diagnostic help, especially in acute diseases of the lung and stomach, and arises through mechanical, chemical or inflammatory stimulation of the phrenic nerve.

3. The author considers pain of the shoulder as it arises in a vast array of conditions mostly infectious in origin, such as septicemia after delivery and miscarriages, generalized osteomyelitis, suppurative inflammations of the shoulder joint, the different kinds of arthritis—especially gout, neuritis and neuralgias of the brachial plexus, myalgias, and also osteitis fibrosa. Tumors are also considered, especially sarcomas. Syphilitic changes are hard to interpret and are often confused with periarthritis of the scapulohumeral joint. There is, however, this difference, in the syphilitic process the site of maximum pain is found on the dorsal aspect of the articular fossa. Tuberculous changes in children express themselves in fungous forms, but in adults rather as a dry caries. Gonorrheal infection in the acute or chronic forms may be accompanied by joint changes. Shoulder pains are characteristic of chronic lead-poisoning and are found occasionally with trichinosis if the embryos of the trichinæ settle in the surrounding muscles.

4. The author places under a class called periarthritis of the scapulohumeral joint all the morbid conditions in the neighboring surroundings of the joint, especially in the subdeltoid space and the numerous bursæ. These have a very definite clinical picture and follow inflammation or accident. Many times pain will arise in the shoulder during the climacterium and one must then consider the disorders of internal secretion or metabolic processes. In this fourth class one frequently will find para-articular calcification in the bursæ or in their neighborhood by roentgen-ray examination. Many times, however, the roentgenogram is negative except for bone atrophy which follows immobilization of the joint.

In the treatment it is very important to splint the joint in abduction, and to use early active and passive motion with massage and local heat. Fever therapy with colon vaccines and short-wave diathermy has been used. Aspiration of the bursa may be necessary. Roentgen and radium radiation have been used. With failure of conservative treatment removal of the bursa is necessary.

(HAIM). HAWTHORNE C. WALLACE, M.D.

Schnek, F. G.: The Origin, Prevention, and Treatment of Contractures of the Shoulder (Entstehung, Verhuetung und Behandlung der Schulterkontraktur). *Wien. klin. Wchnschr.*, 1937, 2: 1127.

This report is concerned only with the contractures of the shoulder which appear after injury. These contractures are mostly the result of the triangular arm sling, which the author calls "the cadaver cloth of the arm." They are found mostly among old people, especially after the use of the bandages of Velpeau or Desault. In the beginning one often finds an effusion into the joint. The contracture is the result of the shortening of the muscles in the neighborhood of the joint, chiefly of the subscapular muscle. The levator scapulæ muscle will quickly atrophy following fixation in the extreme position.

Prophylaxis is the best treatment. Systematically all muscles of the arm must be used daily. There are no patients who alone and without guidance can correctly carry out these motions. The physician must supervise and see that these motions are carried out daily or at least every other day. Also, when the bandages are secure, the patient must be urged to use such joints as are free.

The contracture of the shoulder which is already established should be treated on a double right-angle splint. By this means the joint will be brought into the middle position, with the shoulder abducted to a right angle. The arm at first should not be brought higher than possible without pain. Through the placing of the arm upon the splint the cramp in the muscles decreases, and little by little the arm may be brought into the desired middle position. This is the only correct treatment; baths, massage, and injections are not correct. The splint must be worn uninterruptedly, even at night. From the first placing upon the splint the exercise must go forward to full raising aloft, to adduction of the 90° elevated arm, and eventually to full internal rotation of the arm.

The double right-angled splint is a great advance over the Hacker triangle or the Middledorpf triangle. The new splint is light, is applicable to both sides, and in addition can also be used for the treatment of fracture of the clavicle and dislocation of the acromioclavicular joint.

(SALZER). HAWTHORNE C. WALLACE, M.D.

Spurling, R. G., Mayfield, F. H., and Rogers, J. B.: Hypertrophy of the Ligamenta Flava as a Cause of Low Back Pain. *J. Am. M. Ass.*, 1937, 109: 928.

Low back pain with or without radiation into the legs, together with objective neurological changes, such as sensory or motor loss about the buttocks, sexual impotence, and sphincteric disturbances, must be due to an intraspinal lesion. Hypertrophy of the ligamentum flavum should be considered the cause of such a clinical picture. This hypertrophy occurs most frequently between the fourth and fifth lumbar vertebræ and is probably the result of trauma or strain from postural deformity. It is associated with thickening of the lamina of the fourth lumbar vertebra and produces symptoms by adhesion to the dura and pressure on the cauda equina.

The symptoms in 7 cases which were studied included low back pain of sudden or gradual onset, which was aggravated by exertion or change in position, and relieved somewhat by sitting or standing. Radiating pain in one or both legs was present in all 7 patients. Sexual impotence was complete in 3, sensory loss in the lower lumbar and sacral segments was found in 5, and motor loss in the legs was described by 4. All had some degree of postural deformity with tenderness to pressure over the lower lumbar spinous processes.

A careful neurological examination is essential in differentiating intraspinal from extraspinal lesions. Spinal puncture below the fourth lumbar interspace revealed a block with elevation of the protein content of the spinal fluid, and in 6 patients studied by means of injections of iodized oil a characteristic filling defect was demonstrated opposite the fourth lumbar interspace. The hypertrophy of the lamina was not demonstrated roentgenographically, but in all 7 patients the normal lumbar spinal curvature was absent.

The treatment of this lesion is surgical resection of the involved lamina and hypertrophied ligament. It may be performed under local anesthesia, with the addition of spinal anesthesia if it is advisable to open the dura and inspect the cauda equina. The patient is allowed up on the twelfth postoperative day. Of the 7 patients treated, 1 died of a streptococcic wound infection. The other 6 had prompt relief from symptoms with good recovery.

CHESTER C. GUY, M.D.

Kleinberg, S.: Sciatic Scoliosis. *Am. J. Surg.*, 1937, 37: 418.

Sciatic scoliosis is a lateral deformity of the trunk secondary to a painful lesion of the lower back or buttocks, or to sciatica. The lateral tilt of the trunk is the result of an instinctive effort to assume a posture which will relieve or mitigate the pain.

The subjective symptoms are: [illegible]

1. Pain. The pain is fairly constant and is aggravated by any movement of the trunk or lower limb which puts tension on the sensitive area.

2. Abnormal gait. In severe attacks there is a marked limp and inability to walk more than a few feet at a time.

3. Stiffness of the back. The degree of stiffness varies with the intensity and location of the causative lesions.

4. Deformity of the back. The deformity often causes the patient to go to the doctor early.

The objective signs are:

1. Deformity. The deformity consists of a lateral and forward inclination of the trunk. The back is abnormally flat.

2. Mobility of the spine. All of the movements of the spine are restricted. The anteroposterior mobility is affected to a greater degree than the lateral motion.

3. Muscular spasm. This causes limitation of motion in the back and is the result of an instinctive effort to reduce the pain.

4. Tenderness. Deliberate and accurate testing will give important evidence of the location, extent, and intensity of the lesion.

5. Roentgen-ray findings. The roentgenogram of the back shows a scoliosis. The curvature of the spine in sciatic scoliosis is characterized by marked deviation and very little rotation of the vertebræ. One may find many anomalies which rarely are responsible for the present disability.

6. Additional signs. One often sees atrophy of the thigh and buttocks and a diminution or absence of the ankle reflex on the affected side.

In the history of its onset and course, sciatic scoliosis affects the vigorous and the robust, and is most commonly observed between the ages of twenty and forty years. Men are much more commonly affected.

Lesions of the joints of the lower back are due either to sprains or arthritis. Lesions of the muscles

and fascia of the lower back are caused by strains of the muscles of the back or buttocks, myositis of the muscles of the back or gluteal regions, or by sciatica.

In the myositic type of cases the lesion is insidious and probably due to an infection of the teeth or tonsils, or to an intestinal stasis.

The pathology of sciatic scoliosis is primarily that of the exciting lesions, such as sciatica, sprain, or arthritis of the sacro-iliac or lumbar articulations, as well as derangements of the soft tissues of the lower back.

Sciatic scoliosis is not a complication of any one type of occupation, as it occurs in individuals who lead a sedentary life as well as those engaged in active work.

In the differential diagnosis there must be considered: (1) a general systemic upset; (2) an abdominal or retroperitoneal lesion; and (3) disease of the spinal cord, meninges, or spinal column.

In the presence of any systemic disturbance, it, and not the sciatic scoliosis, should receive primary attention. Should some focus of infection be found, such as an infected tooth, diseased tonsils, sinusitis, prostatitis or intestinal stasis, it should receive appropriate therapy.

Local therapy to the back depends on the type and degree of the sciatic scoliosis, which may be divided into mild, moderate, and severe forms. In mild sciatic scoliosis, the most important single measure is absolute rest in bed. In the moderate sciatic scoliosis the patient should rest in bed for several weeks. After that he should receive physical therapy and wear some form of low-back support, such as a brace, corset, or belt. The most effective support is a plaster-of-Paris jacket. When the individual is ambulatory and receiving physical therapy, manual stretching of the sciatic nerve is frequently effective.

The sciatic nerve may be injected with 1 per cent novocain, or one may employ a caudal block, injecting from 40 to 100 c.cm. of 1 per cent novocain or simple saline solution into the neural canal at the caudal hiatus.

The treatment of severe sciatic scoliosis includes a thorough stretching of the tissues of the back and mobilization of the spine to permit the re-establishment of the normal curve of the spine. In addition, when severe or prolonged sciatica has existed, the sciatic nerve should be stretched to overcome the perineural adhesions.

Open operations are indicated in specific cases. When the symptoms point to an inflammatory involvement of the gluteus medius or maximus, it is well to strip these muscles from the ilium. In cases in which there is definite sacro-iliac arthritis which has not yielded to the rest following the stretching, an extra-articular or intra-articular fusion of the sacro-iliac joints should be performed. In recurring or obstinate lumbosacral arthritis, a spine fusion is considered advisable.

RICHARD J. BENNETT, JR., M.D.

Kulowski, J.: Pyogenic Osteomyelitis of the Pelvis: Analysis and Discussion of 90 Cases. *Arch. Surg.*, 1937, 35: 571.

Of a series of 1,496 patients with pyogenic osteomyelitis seen at the University Hospitals in Iowa City, 90, or 6 per cent, had foci in the pelvis. The age of the patients varied from two to sixty-three years, the average age being sixteen years. In 60 per cent of the group the disease began during the second decade. History of antecedent trauma was present in 35 cases. In 23 cases there was direct infection from neighboring suppuration or open wounds. In 67 cases the localization was hematogenous in origin. In 55 cases the pelvic focus was the initial bony localization. There were two age groups with respect to predilection for growth zones. The first extended from infancy to puberty, at which time the acetabular bones fuse. During this period the lesions tend to be most diffuse, almost invariably starting from the acetabular border. The second group extended from puberty to the age of 25 years, during which time marginal epiphyses were present.

Osteomyelitis in the sacro-iliac region usually began on the sacral side. In 4 cases, in which the lumbosacral joint was involved, the osteomyelitis was bilateral, and all the patients died. In 70 per cent of the cases foci, other than the primary pelvic, developed chiefly by extension, notably to the hip joint.

The bony reaction tended to be "dry," as a subacute or chronic inflammation, while extensive soft-tissue suppuration was characteristic. The generally cancellous nature of the pelvic bones tended rather to the production of caries than sequestration, but sequestra were not uncommon. In the sacro-iliac region, the sequestra were usually small and situated antero-inferiorly. The thin cortical bone of the iliac wing was predisposed to early perforation and sequestration, especially on the pelvic side. Large, irregular purulent cisterns filled with sequestra and debris often developed on this surface. The entire iliac wing was occasionally necrotic. In the later stages of the disease the entire ischium sometimes lay in a soggy bed from which it could be lifted *en masse*. Periosteal bone formation about the pelvis in osteomyelitis was very marked if the periosteum was not necrotic. Frank suppuration was present, in this series, in 83 per cent of the cases and tended to gravitate or invade along the fascial planes. Such purulent collections predominated the surgical picture because they were formidable sources of local and systemic infection.

The diagnosis of the lesion was discussed especially with relation to involvement of the hip and the sacro-iliac joint. In the hip region aspiration was a great diagnostic aid and in the sacro-iliac region exploration and biopsy were indicated when the exact nature of the pathology was difficult to determine. Roentgenograms were indispensable for diagnosis and included the entire pelvis. The injection of sinuses with radiopaque substance was also very important.

The author discusses the results of treatment and emphasizes that the Orr postoperative treatment gave the best results. Including the patients first treated in the hospital and those treated outside before coming in, the mortality was 21 per cent among those receiving radical treatment with adequate resection; 50 per cent among those in whom only soft-tissue abscesses were incised; and 40 per cent among those treated entirely conservatively, without operation. The continued morbidity was also much less among patients treated radically.

The author discusses operative treatment and the anatomical and surgical aspects of different procedures. Primarily, the systemic infection must be taken care of until definite localizing signs appear. Soft-tissue abscesses may be simply incised before definite bony localization can be proved, but when the presence and location of osteomyelitis is established, wide excision of the affected bone is the ideal to be attained. When the Orr postoperative technique is employed, radical operation is not as serious a procedure as might be expected.

Eighteen cases are presented which illustrate various phases of the subject under discussion. Brief discussions of the histories and the operative procedures, and several roentgenograms and photographs are given. ROBERT PORTIS, M.D.

Smets, W.: Juvenile Osteopathy of the Patella (L'Ostéopathie juvenile de la rotule). *Rev. d'orthop.*, 1937, 24: 479.

This lesion is diagnosed by the presence of poorly defined pain phenomena at the level of the tip of the patella with typical roentgenological findings, and corresponds to Koehler's disease of the tarsal navicular. The disease is found in girls between the ages of nine and thirteen and in boys from eleven to fourteen years of age. Clinically, these patients are cured with from a few weeks to a few months of rest.

Changes in the tibial tubercle and the lesser trochanter of the femur may be found at the same time. The lesion is similar to, and often associated with Osgood-Schlatter's epiphysitis of the tibial tubercle. One investigator, by studying a series of roentgenograms, shows that this phenomenon is a normal step in the normal ossification of the patella and has been found in normal children studied systematically. Diseases of the lesser trochanter, the tibial tubercle, and the tip of the patella therefore appear to be but a simple variation of the normal ossification. The possibility of the effect of an endocrine disturbance must be considered.

RICHARD J. BENNETT, JR., M.D.

Carrell, W. B.: The Use of Fascia Lata in Knee-Joint Instability. *J. Bone & Joint Surg.*, 1937, 19: 1018.

The author reports his experience with the use of fascia lata in the treatment of knee-joint instability in repair of the anterior cruciate ligament, support for hyperextension weakness, and repair of the medial ligament.

Repair of the anterior cruciate ligament is accomplished by passing a fascial strip, reflected from the outer side of the thigh, around the lateral condyle to enter the posterior compartment of the knee directly over the origin of the normal anterior cruciate ligament. The attachment of the fascial strip is made through a drill hole in the tibia at the point of insertion for the ligament. The technique of the operation is described in detail. Following operation the knee is put up in plaster in a position of 170 degrees for four weeks. A brace is then fitted and exercise started with gradual extension of the leg. The brace should be worn for from sixty to ninety days. Seven case reports are given in which good results were obtained following this procedure. Patients with uncomplicated cruciate ligament injury and even those with associated rupture of the collateral ligament will recover in most instances if early and adequate fixation is established.

To provide support for hyperextension weakness, a strip of fascia reflected from the outer side of the thigh, 2 in. wide and 8 in. long, is passed between the tibia and the fibula just below the head of the fibula, to reach the posterior compartment behind the knee joint. The strip is drawn upward in contact with the posterior capsule, passed through two drill holes in the posterior surface of the femur, and then directed downward to emerge on the anterior surface of the leg through the same compartment between the tibia and the fibula. It is attached under tension with silk ligatures. Following the operation the knee should be put up in plaster for eight weeks in a position of flexion of 10 degrees more than is desired for future function. On removal of the plaster a brace is fitted and gradual extension is secured. This operation has been performed in 12 cases with no recurrence of hyperextension at the time of writing with apparently good results.

For repair of the medial ligament of the knee a strip of fascia lata is brought out from the posterior surface of the femur to pass over the epicondyle and is attached on the tibia. The leg is put up in a straight position with plaster from the toes to the groin. A walking boot is attached and the plaster is worn for eight weeks. Flexion and function are assisted with quadriceps exercises for another forty or sixty days. One case is reported in which a bone block was added because of extreme displacement.

RUDOLPH S. REICH, M.D.

Kienboeck, R., and Mueller, W.: Os Tibiale Externum and Lesions of the Foot (Os tibiale externum und Verletzung des Fusses). *Ztschr. f. orthop. Chir.*, 1937, 66: 257.

The term "os tibiale externum" is not entirely correct, since this skeletal anomaly represents an enlarged and altered epiphysis of the tuberosity of the navicular bone; it is an accessory bone and is more properly called "os epiphyseos navicularis." An accurate study of the roentgenograms permits a differentiation of four types. The accessory bone may be united with the parent bone; or an abnormal

fibrocartilaginous epiphyseal line may be visible between the two bones. Furthermore, a completely separate accessory bone may be in relation to the body of the navicular bone through an intervening joint; this is an articulating epiphysis. Finally, a completely isolated accessory bone may lie as a sesamoid, wholly within the tendon of the tibialis posticus muscle. The anomaly may appear unilaterally or bilaterally, and may be symmetrically or irregularly developed. The reasons for suspecting this anomaly are mainly spontaneous pain or pain following an injury, after which the roentgenogram reveals the accessory bone. Frequently, an erroneous diagnosis of tuberculosis is made.

Brief histories accompany the respective roentgenograms of 5 verified cases, and reference is made to analogous changes in other portions of the skeleton. (Erlacher). Jerome G. Finder, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Wu, Y. K., and Miltner, L. J.: A Procedure for Stimulation of Longitudinal Growth of Bone. An Experimental Study. *J. Bone & Joint Surg.*, 1937, 19: 909.

Inequality in length of the bones of the extremities may result from one or more of a wide variety of causes which operate during the active growing period of the epiphyses. Either lengthening or shortening may result from the same factors. The former follows irritative or stimulative lesions, and the latter follows destructive affections of the epiphyseal cartilage. In both the clinical and experimental fields, numerous observations have been made on this interesting subject.

It has been observed clinically that injury of the epiphyseal cartilage plate may retard or actually arrest the growth of bone, but in over-riding fractures of the shafts of long bones in children, the resultant shortening is usually equalized by a subsequent compensatory increase in length, and occasionally the affected bone actually becomes longer than the normal one. Infection, tumors, vascular disturbances, infantile paralysis, and congenital anomalies also cause disturbance of the growth of the long bones.

It has been demonstrated experimentally by various investigators that longitudinal growth of bones takes place only at their ends. There are three chief sources of blood supply to each bone: the nutrient artery, the periosteal blood supply, and the epiphyseal blood supply. Disturbance of one or more of these sources is undoubtedly a factor which alters the rate of growth of the epiphyses.

In the experiments performed by the authors on 52 rabbits, various surgical procedures were employed with the hope of finding a method for stimulation of the longitudinal growth of bone. The first three groups of experiments (a repetition with minor modifications of the procedures of Meisenbach, Pearse, Ferguson, and others) failed to produce significant increase in the length growth. By chance, in several animals, the authors observed that stimulation of the length growth was produced by the simple procedure of loosening or stripping the periosteum from the shaft of the bone. Consequently, this operation was repeated on 22 animals, with uniform and significant results. With but 3 exceptions in 22 rabbits, the operated leg showed definite lengthening when compared with the normal leg on the opposite side. Although the amount appeared to be small, it actually represented an increase of from 5 to 15 per cent over the normal growth of the bone during that period of time. Observations of the monthly roentgenograms showed that the most active stimulation of length growth of the bones took place during the first three months following the operation.

The authors are unable to give a definite explanation of the factors which, after the periosteum had been stripped, produced this stimulation of the longitudinal growth. Rudolph S. Reich, M.D.

Williams, S. W.: The Early Treatment of Acute Staphylococcal Osteomyelitis. *Med. J. Australia*, 1937, 2: 459.

The author presents his results in the treatment of acute staphylococcal osteomyelitis, with particular reference to the value of staphylococcus antitoxin. Two contemporary groups of cases are presented, the first group of 24 cases having received staphylococcus antiserum in addition to adequate surgical drainage, with blood transfusions when indicated. The second group of 42 cases was a control group, in which no serum was given.

The mortality rate was the same in both groups, 16 per cent. When the results were compared from the standpoint of duration of temperature, sequestrum formation, metastases, and apparent wound healing, no significant differences were noted in the two groups. Despite these results, the author had the clinical impression that several of the cases had been benefited by serum therapy. He suggests that possibly one of the reasons why serum had apparently not proved of great value in this investigation was the use of too low a dosage.

Daniel H. Levinthal, M.D.

Leveuf, J., and Perrot, A.: Tendon Transplantation in the Treatment of Paralytic Club-Feet (Les transplantations tendineuses dans le traitement des pieds bots paralytiques). *Rev. d'orthop.*, 1937, 24: 393.

In paralysis of the sural triceps muscle the transplantation of the posterior tibial and short lateral peroneal tendons does not alone give a satisfactory result. The best results have been obtained when the longer peroneal tendon is transplanted into the calcaneus. In transplantation of the two peroneal and the posterior tibial tendons there is a marked discrepancy according to the resported results, and failures are reported in some instances. In some cases the plantar flexion was satisfactory, but cavus

that did not exist before was produced. Antagonistic transplants will apparently function properly if Scherb's law is obeyed. The law, in short, is that all muscles previously antagonistic must remain completely paralyzed in order that the transplant may function.

The short peroneal and posterior tibial tendons are mechanically poor transplants, the peroneus longus being the logical substitute in this paralysis.

In paralysis of the anterior tibial muscle transplantation of the extensor hallucis longus compensates for flexion-adduction paralysis.

If the extensor hallucis longus is insufficient, its effort may be augmented by a tendon of silk from the extensor digitorum communis longus attached to the inner border of the foot. Better yet, the entire extensor digitorum communis longus may be transplanted into the anterior tibial muscle along with the extensor hallucis longus.

In transplantation of the long lateral peroneal tendon into the anterior tibial muscle, Scherb's law again holds true. The authors have shown that the transplanted muscle contracts voluntarily, but that there is no contraction in the course of automatic walking.

Transplantation of the short peroneal tendon is not, as in the case of the long peroneal tendon, a purely antagonistic transplantation. Scherb has stated that this muscle may be transplanted as a flexor or as an extensor. The short peroneal tendon is a very poor transplant.

When the anterior tibial and posterior tibial muscles are paralyzed a valgus exists which is always difficult to correct.

Two cases of Mommsen are cited in which excellent results were obtained from transplantation of the extensor hallucis longus tendon into the anterior tibial. Five cases of Gocht are reported in which the results were poor.

Transplantations of the long peroneal tendon into the inner side of the foot give questionable results; in fact, the use of this muscle is contra-indicated.

Transplantation of the short peroneal tendon combined with that of the extensor hallucis longus, has been found satisfactory.

The hypercorrection following transplantation of the two peroneal tendons is due more to the total suppression of the pronators than to the efficiency of the transplanted muscles.

In paralysis of the peroneal muscles with or without paralysis of the extensor communis, transplantation of the anterior tibial tendon to the external border of the foot is very likely to cause a hypercorrection of the valgus. Some surgeons prefer to transplant the extensor hallucis longus, but several other plans are also suggested.

The results of transplantation of the extensor hallucis longus tendon to the external border of the foot are universally poor because of the weakness of this muscle.

Transplantation of the extensor hallucis longus and the flexor hallucis longus tendons to the plantar surface of the cuboid have been tried with total failure.

In equinus foot the reëstablishment of muscular equilibrium should overcome weakness of the triceps and produce a balanced lever, that is, a calcaneus versus muscle transplant. Methods of improving this condition are: (1) the transplantation of healthy tendons to the midtarsal portion of the foot; (2) lengthening of the sural triceps; (3) transplantation of the extensor hallucis longus into the anterior tibial tendon; and (4) transplantation of two tendons of the extensor digitorum communis longus.

Transplantation of the posterior tibial tendon into the first metatarsal across the interosseus space may be of value.

In hollow foot the tendon of the extensor hallucis longus has been transplanted to the head of the first metatarsal following correction of the cavus by the method of Steindler-Spitzy. In 1 case a subastragular arthrodesis was carried out to correct the varus. In 3 cases good results were obtained.

RICHARD J. BENNETT, JR., M.D.

FRACTURES AND DISLOCATIONS

Campbell, W. C.: Malunited Colles' Fractures. *J. Am. M. Ass.*, 1937, 109: 1105.

The author presents an operation for the correction of malunited Colles' fracture. Following an ostectomy of the radius about .75 of an inch above the joint, he removes a pyramidal wedge of bone from the medial aspect of the lower extremity of the ulna. He inserts this graft into the space made by the ostectomy as the lower end of the radius is forced downward and forward. This procedure corrects both the shortening and the dorsal angulation of the lower end of the radius as well as removes the prominence of the ulnar head.

The author has done this procedure in 19 cases, in 11 of which the end-results are excellent; 7 are unknown; and 1 case is too recent for the determination of the amount of function.

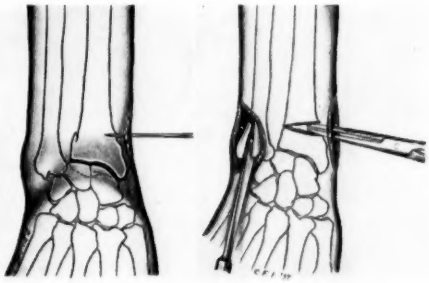

Fig. 1. Fig. 2.

Fig. 1. Osteotomy of the radius three-fourths inch proximal to the articular surface. Fig. 2. Hemostat inserted between fragments to correct radial shortening, pyramidal wedge of bone removed from ulna.

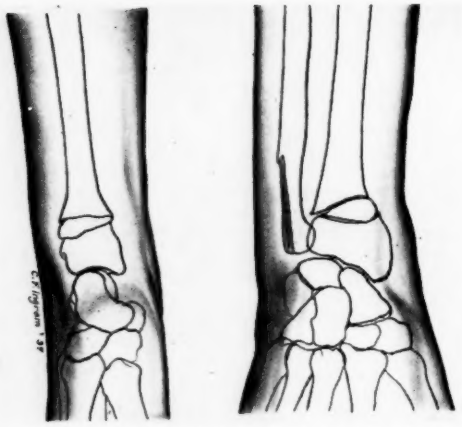

Fig. 3. Posterior angulation corrected by dorsal wedge of graft; radial length maintained by lateral wedge of graft; prominence of ulna removed.

Drawings and roentgenograms illustrate the article. BARBARA B. STIMSON, M.D.

Burnett, J. H.: Further Observations on the Treatment of Fracture of the Carpal Scaphoid (Navicular). *J. Bone & Joint Surg.*, 1937, 19: 1099.

The author presents a study based on the end-results of fracture of the carpal scaphoid, covering a period of from four to seven years after injury.

During 1934, 1935, and 1936, 100 patients with this fracture were treated in the out-patient department of the Boston City Hospital. Inasmuch as 48 per cent of these patients were twenty years of age or under, the author believed that the condition

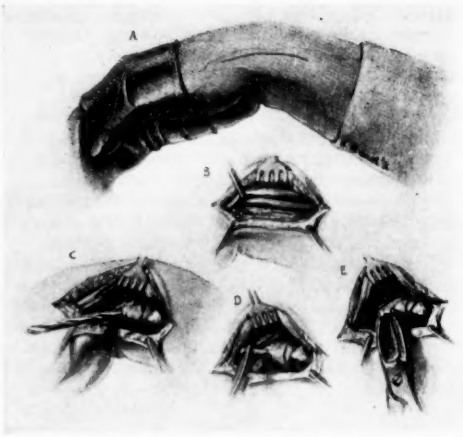

Fig. 1. Operative technique.

was one which affects young people and should be treated early. Any sprained wrist which does not clear up in a month should be roentgenographed again with a fracture of the scaphoid in mind. If the diagnosis is made in a fresh case the author believes that a plaster-of-Paris cast in a cock-up position with slight radial flexion should be applied and maintained for at least six weeks. When there is a marked separation of fragments he believes it is possible to reduce the fracture and peg the fragments. In late cases with non-union, operative treatment with the use of a bone peg has given satisfactory results. He describes the type of operation he advocates.

Roentgenograms and case histories illustrate the article. BARBARA B. STIMSON, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Verschuyl, E.: Dangers of Arteriography (Die Gefahren der Arteriographie). *Nederl. Tijdschr. v. Geneesk.*, 1937, p. 1007.

The author reports on the complications of arteriography. Described first of all in the French literature is cyanosis of the skin with characteristic violet spots. These spots later become gangrenous. The gangrene may develop without any transition stages. A summary of the reports on the clinical and experimental use of various contrast media is made. Organic iodide compounds as well as thorotrast can cause damage to the vessel endothelium. Perabrodil has no vasomotor influence. Thorotrast dilates the vessels. Uroselectan and tenebryl cause a spastic contraction of the vessels, followed by a dilatation of the capillaries and veins with stasis. In order to determine the individual reactivity of the vasomotor system to arteriography, adrenalin and histamine were injected. The following case is reported:

Sudden pain occurred in the right leg in a seventy-year-old man. The leg became pale, sensitive and cold. The pulse was not palpable. Vascular spasm or embolus occurred and arteriography was performed. The aorta was punctured at the level of the third lumbar vertebra and 20 c.cm. of 35 per cent perabrodil were injected. After this 0.03 gm. of eupaverin with atropine were injected intramuscularly. The roentgenogram showed a closure of the right common iliac artery just proximal to its point of division. Shortly after the perabrodil injection, before the eupaverin could take effect, the color of the leg was normal, but the pulse was not palpable. Death occurred suddenly two days later. At autopsy the pericardial sac was filled with blood in consequence of a tear in the ascending aorta. All layers of the ascending and descending aorta could be easily separated. A large retroperitoneal hematoma was found. There was no tear in the abdominal aorta, occlusion of the right leg vessels, nor appreciable arteriosclerosis.

The authors attributed the sudden release of the arterial spasm and the death to the perabrodil injection. The aorta puncture caused the retroperitoneal hematoma, favored by the friability of the aorta. On the basis of 2 cases, the author also warns of the possibility of epileptic convulsions after perabrodil injections into the subclavian artery.

(Heineche). Philip Shapiro, M.D.

Lindgren, S.: Arterial Symptoms in Deep Thromboses of the Leg (Arteriensymptome bei den tiefen Beinthrombosen). *Upsala Läkaref. Förh.*, 1937, 42: 415.

The author has observed 2 cases in which thrombosis of the deep leg and pelvic veins was ushered in by signs of a massive arterial embolism, absence of pulse, a mottled corpse-like coloring and coldness of the extremities, and disturbances of the reflexes and sensibilities. Immediate exposure of the artery in one case, and autopsy in the other demonstrated open but markedly contracted arteries and a fresh venous thrombosis. A number of similar cases are described in the literature. These observations induced the author to study the relation of the arteries to the usual thromboses of the femoral and iliac veins.

According to Nystroem and Guilleminet, the weakening of the pulse in the femoral artery in the groin as compared to the normal side, is an early symptom of venous thrombosis, even before the occurrence of edema. The author has studied the question by oscillometry. This showed that the blood flow in the artery was diminished in most cases, if not in all, by deep venous thrombosis. The diminution in the arterial pulse wave is most apparent in the first few days, especially on the first day. Then the blood flow in all cases again returns to normal after a variable period of time; but no prognostic conclusions can be drawn from this. The diminution of the blood flow is independent of the occurrence of an edema and the narrowing of the arterial lumen by the travelling arterial thrombi, and is rather the result of a spastic contraction of the vessel. This vasoconstriction results not only from stimulation by the thrombi but is also on a functional basis since only a moderate amount of blood can flow through the thrombosed veins. A diminution of the arterial blood flow occurs, however, only in thromboses of the large deep veins, not in thrombophlebitis of the saphenous vein or of the smaller venous branches of the lower extremity. The oscillometric study is valuable for early diagnosis of deep thromboses, although, according to Nystroem, the determination of a weakening in the femoral pulse by means of palpation is just as effective in all cases in which there is a definite diminution noted by oscillometry.

(von Hasselbach). Jacob E. Klein, M.D.

Lund, C. C.: The Treatment of Embolism of the Greater Arteries. *Ann. Surg.*, 1937, 106: 880.

This report was developed by the author from data derived from the case reports of 55 patients upon whom the diagnoses of peripheral arterial embolism and thrombosis had been made. The abbreviated case histories form a part of this report and are considered with respect to the condition of the patients at the time of their discharge from the hospital.

Until recently, the only active treatment of arterial embolism considered to be of real value was the operation of embolectomy. Two new non-operative procedures and one new operation have come into use with claims made for them that results can be

secured that are at least as good as, if not better than, those following embolectomy. These procedures are: (1) the use of a pulsating negative pressure pump to stimulate the circulation in the affected limb; (2) the use of an anti-spasmodic drug to overcome the immediate arterial spasm that follows the lodgment of the embolus; and (3) the operation of arteriectomy, performed when a leg is affected, in conjunction with procaine anesthetization of the lumbar sympathetics.

To determine the best treatment or combination of treatments suggested by these procedures, it is important to study the results in a series of cases treated by any of these methods. In presenting this group of patients who were treated, for the most part, by embolectomy, the author brings out certain features of the problem not previously emphasized.

Emboli that lodge in peripheral arteries usually arise in three places. The most common source is from the left side of the heart. The two less common sources are from the wall of an artery and from the pulmonary veins. In the event of an abnormal opening in the heart, such as a patent foramen ovale, paradoxical emboli arising in the peripheral venous system or right auricle may find lodgment in the peripheral arteries.

The effect of an embolism is to decrease the arterial blood supply to the area served by the artery or arteries involved. In the case of an end artery, the result may be immediate and complete gangrene of the tissue or organ. In most situations the effect is relative, the degree of impairment of the blood flow varying with the efficiency of the collateral circulation.

After presenting detailed tabulations with discussions concerning them, the author, in this study of cases seen or treated personally, concludes that after experience had been gained quite good results followed the operation of embolectomy when it was performed early on the arteries of the leg. No benefit is gained by such operations on the upper extremity. Embolism of the upper extremity, as distinguished from that of the lower, very seldom leads to gangrene. Nearly all of the patients who did not undergo embolectomy died, whether or not there was gangrene or amputation.

HERBERT F. THURSTON, M.D.

BLOOD; TRANSFUSION

Domanig, E.: The Transfusion of Preserved Blood (Die Transfusion konservierten Blutes). *Wien klin. Wchnschr.*, 1937, 2: 1067.

Three conditions must be fulfilled for the preservation of blood: (1) hemolysis must be prevented, (2) the blood must remain sterile, and (3) the blood must be preserved in an icebox at 4° C. The author fulfilled these conditions by the addition of a solution containing sodium citrate 1.0, pure glucose 2.0, sodium chlorate 0.2, and distilled water 100.0, to an equal amount of blood. This solution could be kept in condition for six weeks. The preserved blood showed a definite layering between the sedimented red corpuscles and the supernatant fluid derived from the blood serum and preserving fluid. If the solution does not show such a sharp line of demarcation, or if there is the slightest red tinge to the supernatant fluid it should not be used.

The blood is kept in a paraffin-coated Percy tube, where it is mixed with the preserving fluid. Before use it is filtered through several layers of sterile gauze and administered by means of the Oellecker apparatus. Eighteen transfusions with conserved blood were carried out. The longest period that the blood was preserved was thirty-four days.

There were no severe reactions, but this experience demonstrated that no other substance could be added to the blood to be transfused. Heating the blood over 40° or heating it over an extended period, as well as the addition of physiological salt solution or 5 per cent glucose solution caused hemolysis.

The author prefers continuous intravenous drip in brain operations and is of the opinion that preserved blood is not equally as good for transfusion as fresh blood. (JUNG). WILLIAM C. BECK, M.D.

Wikulow, A. W.: Blood Transfusion in Obstetrics (Bluttransfusion in der Geburtshilfe). *Akuš. i. Ginek.*, 1937, 5: 52.

The most frequent indication for blood transfusion in obstetrics is afforded by severe blood loss and the consequent endangered condition of the patient. According to the author it is not always easy to decide whether the blood transfusion is immediately indicated. In cases of sudden severe hemorrhage, the blood pressure, erythrocyte count, hemoglobin values, and quality of the pulse may all afford an erroneous impression. In any case the author regards it unconditionally necessary to determine the blood group of every woman entering the clinic for delivery, so that in case of necessity blood transfusion may be done with as little delay as possible.

From his own experience he finds himself a proponent of the most extensive recourse to blood transfusion. On the basis of copious statistical material, he shows the beneficent effects of such transfusions. Not only is there immediate improvement in the subjective findings of the patient, but likewise in the condition of the heart, vascular system, blood picture, and hemoglobin values, and, last but not least, there is a favorable influence on infectious processes.

(VON GLASENAPP). JOHN W. BRENNAN, M.D.

SURGICAL TECHNIQUE

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Kernan, J. D., and Barach, A. L.: The Rôle of Helium in Cases of Obstructive Lesions in the Trachea and Larynx. *Arch. Otolaryngol.*, 1937, 26: 419.

The inhalation of helium to relieve obstructive dyspnea is based on the molecular lightness of this gas in comparison to nitrogen. A mixture of 80 per cent nitrogen and 20 per cent oxygen is three times as heavy as a mixture of 80 per cent helium and 20 per cent oxygen. The pressure required for moving a mixture of helium and oxygen is approximately one-half that required for moving air. Whenever there is obstruction to the movement of air in the respiratory tract, increased pressure is necessary to transport a volume of air to and from the lungs. If the obstruction is severe the respiratory musculature, even at maximal effort, becomes unable to ventilate the lungs with a volume of air sufficient to maintain respiratory function. Human subjects can breathe through a narrow orifice with from 35 to 50 per cent less pressure when a mixture of helium and oxygen is inhaled instead of either air or an atmosphere of 100 per cent oxygen. The pathological consequence of unrelieved respiratory obstruction, in either the larger or the smaller air passages, is the development of congestion and edema in the lung. The negative pressure which is induced within the chest during inspiration against a restricted orifice is from seven to ten times the normal value and exerts a suction action on the pulmonary capillaries. The first effect of increased negative chest pressures is to reduce the resistance of the flow of blood through the lungs; in addition, the dilating effect of the negative pressure on the right auricle and ventricle may increase the diastolic volume. The end-result of inspiratory obstruction is not only congestion and edema in the lung but also circulatory failure. The elevated negative pressure within the chest exercises suction on the capillary walls. This is the important factor in the production of intra-alveolar exudate. In addition, blood accumulates in the lung, building up an increased capillary blood pressure which makes for oozing of serum. As the lungs fill with blood an increasing negative pressure becomes necessary to ventilate them adequately; in this way a vicious circle takes place in which the increased effort to breathe is followed by an increased pathological state in the lung. These changes result from obstruction to inspiration and not from obstruction to expiration.

Employment of any remedy which will lower the pathologically elevated intrathoracic negative pressure not only will facilitate the ventilation of the lungs, but will ameliorate the consequences of increased negative pressure, and thereby tend to prevent both congestion and edema in the lungs, as well as the conceivable disproportion in the output of the two ventricles and consequent failure of the left heart. At the onset of respiratory obstruction a sensation of dyspnea takes place in the absence of oxygen deficiency or accumulation of carbon dioxide. The human organism is accustomed to a certain velocity of air-flow in and out of the lungs, which appears to be interpreted through the Hering-Breuer reflex. The increased muscular effort necessary to maintain adequate or accustomed pulmonary ventilation gives rise to dyspnea. The inhalation of pure oxygen in this instance does not modify the sensation of shortness of breath, since there is equally as great effort in inhaling an atmosphere of 100 per cent oxygen as there is in inhaling air, there being little difference in the density of the two gases. However, when obstruction is long continued, breathing becomes rapid and shallow, and in addition, changes in the pulmonary circulation and the alveolar membrane take place, which give rise to anoxemia. Under these circumstances the inhalation of an atmosphere rich in oxygen aids the patient in two ways: (1) by decreasing the pulmonary ventilation, and (2) by increasing the functional capacity of the heart muscle. A decrease of the negative pressure within the chest does take place under these circumstances, i.e., when an atmosphere of 100 per cent oxygen is breathed. This decrease in the intrapleural negative pressure is related to the lessened volume of gas inhaled. Since a mixture of helium and oxygen may enter and leave the lungs with even less effort and with a more marked lowering of the intrapleural negative pressure than mixtures of oxygen and nitrogen, this mixture seems more applicable to the patient with obstruction in any part of the pulmonary airway. The effectiveness of helium is increased by administering the gas under a slightly positive pressure.

In clinical experience the mixture of helium and oxygen is generally administered at a positive pressure of between 2 and 4 cm. of water. This degree of increase in pressure decreases the inspiratory effort without unduly limiting the entrance of blood into the right heart. The concentration of oxygen employed is between 21 and 35 per cent, and depends on the degree of anoxemia which the patient presents. A concentration of 25 per cent oxygen, the remainder of the atmosphere being helium, tends to counteract the anoxemia frequently present and at the same time, by maintaining a high concentration of helium, overcomes the respiratory fatigue by decreasing the muscular effort necessary for breathing.

Of 21 patients, 11 received marked relief from the signs of obstructive dyspnea. Seven of these patients were removed from the atmosphere of helium and oxygen without the need for tracheotomy, although

1 of them had a tracheotomy as a precautionary measure two days later. All of them recovered. In the remaining 4 patients of this group who experienced marked relief as a result of the helium and oxygen therapy, there was ultimately a fatal outcome, as a result of tumor in 2, due to a thyroid crisis in 1, and due to bronchopneumonia and subsequent tracheotomy in 1. In 3 patients little or no relief was evident, 1 patient being a marasmic infant with bilateral bronchopneumonia, the second having severe laryngeal diphtheria, and the third being a boy with leucemia who had showed marked sloughing of the epiglottis and the uvula.

MANUEL E. LICHTENSTEIN, M.D.

Duval and Mourgue-Molines: Pathological Physiology and Treatment of Recent Extensive Cutaneous Burns (Physiologie pathologique et traitement des brûlures cutanées étendues récentes). *Presse méd.*, Par., 1937, 45: 1421.

In opening the discussion on recent extensive cutaneous burns at the 46th Congress of the French Surgical Society, Duval defined the subject under discussion as including second and third degree burns involving at least a third of the cutaneous surface, and took up the pathology, symptoms, and treatment during the first four to ten days. Such extensive burns often prove fatal, the mortality ranging from 40 to 100 per cent in the most extensive lesions.

The clinical syndrome is that of severe, subacute toxemia. There is an initial period of nervous excitability followed by weakness and coma. The secondary symptoms include vomiting, diarrhea, and incontinence of the urine and feces. The blood pressure is low and the pulse rapid; the temperature is usually normal or subnormal. Patients with severe burns often die without developing fever, but in some cases there is fever with a temperature of from 40° to 41° C. The amount of urine is usually small, with much albumin and blood; but in some cases the urine is normal both in amount and character, and the renal function normal. The cutaneous lesions are variable; in some instances all the layers of the skin are totally destroyed, in others the corium is only partially destroyed. In the burned surface there are small areas or "nests" of normal tissue that make regeneration possible. It is to be noted that the normal skin outside of the burned area shows some of the same characteristics as the burned skin; for instance, the burned skin and the vesicles that form in the burned area contain an excess of chlorides; so also does the normal skin of these patients. The burned skin is toxic; in experimental animals its excision saves the life of the burned animals; if it is grafted on a normal animal, this animal dies. All the organs of the body may show pathological changes in cases of extensive cutaneous burns. Examination of the blood shows hyperglycemia, acidosis with diminution of the alkaline reserve, adrenalinemia, hyperleucocytosis, increased concentration of the blood, increased urea, and diminished chlorides.

The toxemia in extensive cutaneous burns in the first four days is not complicated by infection, but later infection may develop in the burn and complicate the clinical picture. The toxemia resembles to a certain extent the toxemias caused by exogenous toxins, but in reality the toxemia of cutaneous burns is caused by toxic substances developed in the burned tissues by the destruction of tissue proteins. Polypeptids and uric acid are present in the blood, which is evidence of the abnormal destruction of proteins. The toxemia of cutaneous burns resembles most closely three other conditions: traumatic shock resulting from extensive destruction of tissue, postoperative toxemia, and roentgen-ray, or radium toxemia. All these conditions are due to extensive destruction of the patient's own tissues with the production of toxic substances which enter the general circulation. It is possible that the symptoms in some cases of extensive burns may be of the nature of anaphylactic shock, but this cannot yet be stated definitely on the basis of either clinical or experimental findings.

Mourgue-Molines in discussing the treatment stated that the immediate treatment of a severely burned patient should include the administration of morphine to relieve pain, keeping the patient warm, and cardiac tonics. To combat the toxemia, administration of fluids is indicated and especially saline solution, isotonic or hypertonic, is indicated because of the hypochloremia; blood transfusions are also of value; small repeated transfusions of from 250 to 300 c.cm. give the best results. Digitalis may often be employed with good effect; atropin and calcium chloride are suggested for their action on the vegetative nervous system; sodium hyposulphite is recommended for its action on sulphur metabolism; and in some instances adrenal extracts are indicated. In some cases tetanus antitoxin or antistreptococcus serum may be indicated as a prophylactic against subsequent infection.

In regard to the local treatment, the author does not approve of the use of fatty substances such as oils, as, while they relieve pain, they favor toxic absorption. To prevent toxic absorption, careful cleansing of the burned area is indicated, but surgical excision of the burned tissue is rarely possible in extensive burns; the continuous bath is dangerous because of its depressing action on the heart. The author considers that desiccation is the method of choice, either by exposure to air with or without a hot-air tent, or by the application of tannic acid or such substances as silver nitrate, gentian violet, or mercurochrome. In extensive burns of the trunk, the author has found the combination ot tannic acid and silver nitrate proposed by Bettman very useful. While tannic acid gives good results in burns of the second degree, in third degree burns he believes the resulting coagulum is too thick and rigid. In such deep burns he prefers the use of gentian violet or mercurochrome. If no infection supervenes, general treatment can usually be discontinued gradually. In burns of the second degree, the crusts formed over

the burned area usually fall off spontaneously. In burns of the third degree, the crusts must be removed by the application of wet saline or Dakin solution dressing for twenty-four hours. Often skin grafting is necessary after a brief preparation of the field with ultra-violet irradiation.

In the discussion, a number of surgeons reported favorable results with the tannic-acid treatment of burns. ALICE M. MEYERS.

Maier, R. L.: Human Bite Infections of the Hand. *Ann. Surg.*, 1937, 106: 423.

At Bellevue Hospital the author collected a series of 17 human bite injuries to the hand in a year.

Such injuries are usually sustained in a fist fight and involve the knuckles on the dorsum of the hand.

The author believes the resulting infections and complications are due to an injury to the underlying and moving tendon or to penetration of the joint. The injured extensor tendon may retract proximalward from the site of laceration of the skin and is often neglected. Any effective treatment must take into account the possibility of the retraction of the tendon or injury to the joint. Local treatment to the skin laceration alone may be disastrous.

The course of the infection following such injuries is quite uniform. If the extensor tendon is injured, the infection will extend proximally along the course of the tendon on the dorsal surface of the hand as an ascending infection. Sloughing of the tendons may result. If both the tendon and capsule of the metacarpophalangeal joint are injured, in addition to infection along the tendon, the joint may become infected and point into the palm or involve the flexor tendons.

The results obtained in these infections are directly proportional to the time elapsing between the receipt of injury and the institution of adequate care. Prompt and adequate treatment is necessary to prevent crippling deformities.

Cultures, both aerobic and anaerobic, usually show a mixed culture, with the Vincent organism predominating.

The most effective treatment in this type of injury is a thorough débridement of the injured area under a bloodless field. A careful examination of the underlying tendon is made for any evidence of injury or infection. All tissue even suggestive of infection is removed. If evidence of extension into the palm exists, it should be opened widely at this time. Salvarsan is then applied to the wound, which is packed with plain or iodoform gauze. Salvarsan is applied daily for two or three days and at each dressing the wound is irrigated with hydrogen peroxide. The dressings are kept wet with boric acid or magnesium-sulphate solution.

If, after careful examination of the patient, conservative treatment is decided upon, the patient should be carefully but continuously observed for twenty-four hours; in this time the infection will manifest itself and radical treatment can be instituted. HARVEY S. ALLEN, M.D.

Bigger, J. W.: The Staphylococci Pathogenic for Man. *Brit. M. J.*, 1937, 2: 837.

The outstanding discoveries of the past fifteen years concerning the pathogenic staphylococci pyogenes are reviewed. From the labors of many workers the knowledge is available that staphylococci produce at least three toxins: a, B, and leucocidin, of which the first and last are of importance in relation to human disease, while the rôle of the B toxin is less certain. The antitoxins to these can be titrated in the blood sera of men and animals, whether normal, infected, or immunized. It is possible actively to immunize men and animals against these toxins, and for the treatment of human disease the antitoxic sera of immunized animals may be used. Coagulase, another soluble product of most staphylococci, does not cause clotting of the plasma in many specimens of human blood, probably because of the presence of anticoagulase. Attempts to devise satisfactory skin tests have been complicated by the fact that most human beings give positive reactions. There is a surprising absence in recent literature of any mention of opsonins; the author, however, hesitates to reject them completely.

The essential of treatment of staphylococcic infection should be rest and lack of interference. This inactive treatment applies to boils and carbuncles wherever situated and not merely to infections about the face. Incision should be made only when liquefaction has occurred. When general symptoms are marked or the local lesion is extensive, antitoxic serum should be used. In chronic and recurring infections it is important to search for a primary infection which is often present in the nose, to investigate the sugar metabolism, and to produce active immunization with toxoid containing the three elements described, with an average of eight gradually increasing injections. The author believes that vaccines should not be entirely abandoned since they may help to establish an antibacterial immunity. He, therefore, suggests the use of both toxoid and autogenous vaccine in which the cocci have been washed free of toxin and toxoid.

Food poisoning due to pathogenic staphylococci receives mention. The source of the organisms which have multiplied in the food and there formed toxins is reported to have been either the human skin or cow's milk. WALTER H. NADLER, M.D.

Gottesbueren, H.: Gas Gangrene following Amputation for Trophic Ulcers (Gasoedemerkrankung nach Amputation wegen trophischer Geschwuere). *Zentralbl. f. Chir.*, 1937, p. 1929.

Zeissler and Stockenius have recently reported 14 sudden and unexpected deaths from gas gangrene from various portals of entry. This is hardly to be wondered at as the Fraenkel bacillus is found constantly in the earth as well as in the animal and human intestine. It is almost constantly present in wounds and necroses. Nevertheless, the carriers are only rarely infected. Franz estimated the frequency during the World War at 0.5 per cent, and the French

Sanitary Report gave it as 0.46 per cent. The latent infection is noteworthy. Infection did not occur when the projectile entered the body, but followed its removal. The longest period of latency was eighteen years. The operations, however, were in the traumatized areas. It is a new finding that infection can occur when the operation is in a distant part of the body. Konjetzny reported a case:

Fifteen years previously the patient had received a gunshot wound of the leg. Because of torpid trophic ulcers on the foot amputation was performed in the midcalf. Three days later gas gangrene was demonstrated both clinically and bacteriologically. Recovery followed amputation of the thigh and the administration of gas serum.

The author reports two additional cases. The first was that of a man sixty-one years old who had had an amputation of the left thigh for arteriosclerosis and diabetes in 1933. In 1935 cyanosis of the right great toe was found. The toe was disarticulated because of the refusal of a higher amputation. The necrosis continued. Midcalf amputation was performed, as again higher amputation was refused. Two days later gas edema from Fraenkel bacilli was found. High thigh amputation and gas serum produced a cure.

The second case was a thirty-nine-year-old man with a large ulcer on the dorsum of the foot following an endarteritis obliterans. Sympathectomy was without result. Therefore, amputation was performed in the midcalf area. After four days typical gas edema from the Fraenkel bacillus was found. Healing followed the use of serum and incisions.

That there are gas bacilli present in torpid ulcers has been shown by Biengold, Zeissler, and Mausson. All the patients had the same disturbance of the circulation. Injured patients in whom there is an injury to the blood vessels are especially prone to gas edema. Franz has shown that 27 per cent of such injured present gas edema. It was also noted in the war that some patients developed the disease following ligation of the popliteal artery. Therefore, in amputations performed for ulcerations caused by thromboses, endarteritis obliterans, or arteriosclerosis, a prophylactic dose of gas serum should be administered. Should the disease set in in spite of this, serum therapy should be energetically pursued.

(Franz). William C. Beck, M.D.

Lower, W. E., and Tormey, T. W., Jr.: Gas Gangrene and Its Treatment. *Surg. Clin. North Am.*, 1937, 17: 1385.

The authors review our present knowledge of the cause, diagnosis, and treatment of gas gangrene.

The spore-forming anaerobic bacteria causing gas gangrene occur in the soil, dirt of the street, on the skin, and in the intestinal tracts of man and animals. The infections are usually mixed with the ordinary pyogenic organisms, such as the staphylococcus or streptococcus. The incubation period is from one to four days. Gas is believed to be produced in the tissues by the fermentation of glycogen.

Clinically, pain is out of proportion to the severity of the injury, probably due to the pressure of the gas. Crepitation may be elicited, gas bubbles seen if the wound is open, and the odor is distinguishable. Smears show a gram-positive rod-shaped bacillus. X-rays may show the muscle bundles more clearly than normally because of the presence of the gas. The temperature may rise to 102° F.

Before the advent of serum therapy the mortality was about 50 per cent; at present it is from 17 to 20 per cent.

Prophylactic treatment consists in immediate thorough cleansing and débridement of wounds suspected of contamination. Particular stress is laid upon the removal of non-viable tissue and foreign objects.

Wounds which cannot be closed because of deep pockets or dead spaces are treated by irrigation with potassium permanganate, hydrogen peroxide, or some other antiseptic.

Amputation of an extremity is advised if the circulation is hopelessly damaged.

Four thousand units of polyvalent gas-bacillus antitoxin combined with 1,500 units of tetanus antitoxin are given to every patient with extensive or suspicious wounds. This dose may be repeated in from four to six hours. Patients should be tested for sensitivity before the administration. General supportive measures must not be neglected.

Curative treatment must be prompt and is started with from 10,000 to 20,000 units of antitoxin given intravenously or intramuscularly and this is repeated from every four to six hours until 100,000 units have been given.

Incisions should be made in line with the skin folds and the muscles separated in line with their fibers. Necrotic and injured tissue is excised. Opening the wound to the air and exposing dead spaces for irrigation is particularly important. Tissues infected following parenteral medication or fluids are best treated by through and through irrigation with hydrogen peroxide. X-ray has been reported as efficacious possibly because of the liberation of hydrogen peroxide in the tissues.

Thomas C. Douglass, M.D.

POTENTIAL DANGERS OF THOROTRAST AS A CONTRAST AGENT IN ROENTGEN DIAGNOSIS

Collective Review

WILLIAM H. STEWART M.D., and FRANCIS H. GHISELIN, M.D., New York, New York

THE original work on thorium dioxide sol for the roentgenographic visualization of the liver and spleen was done by Oka who published an article in German in 1928. A second communication, published in 1930 (7), stated that his conclusions at that time were that the described method of lienography was of practical value and that the results were dependent upon the deposition of thorium particles in the cells of the reticulo-endothelial system. He stated that he had conducted many animal experiments and concluded that the method was practical. He had administered thorotrast to 6 normal patients in doses of from .07 to .15 gm. of thorium dioxide per kgm. of body weight and obtained satisfactory shadows of the spleen. He believed that much larger doses were necessary for the demonstration of the liver and found that immediate reactions occurred which included fever and diarrhea. He stated that these immediate reactions should not be seriously considered as they usually did not occur. Since that time several workers used thorotrast as a diagnostic medium in large groups of cases.

Rigler, Kouchy, and Abraham (8) reported 175 cases in *Radiology* in 1935 and Yater (13) and his associates reported a group of over 200 cases in *Radiology* in 1936. In a five-year period Yater had given a stabilized colloidal solution containing approximately 22 per cent of the metal by volume. The administration had been intravenous in divided doses of 25 c.cm. on successive days. The amount of the solution injected contained radio-active material equivalent in alpha radiation to from 1.5 to 3.0 micrograms of radium. The authors believe, however, that the beta and gamma radiations are not present in significant quantities. A five-year observation of many of their cases has shown large quantities of thorium retained in the tissues for that period of time. An analysis of the series failed to show any significant immediate reactions. These authors speak very highly of the diagnostic value of the procedure and consider that this procedure was particularly valuable in: (1) differentiation of a mass in the upper abdomen from the liver and spleen, (2) diagnosis of cirrhosis of the liver when fibrotic replacements displaced the Kupfer cells and caused areas of decreased density in the shadow of the liver, (3) syphilitic cirrhosis (hepar lobatum), (4) metastatic nodules in the liver, (5) primary carcinoma of the liver, (6) abscess of the liver (1 case), (7) cysts, (8) amyloidosis, in other diseases, such as hepatitis, ruptured spleen, and ascites, and in determination of the position of the diaphragm.

Yater now has 47 patients living who have received thorotrast. Their ages range from three to seventy-four years. Fourteen of these patients had been injected with thorium more than four years previous to the time of the report. The author states that not one of the patients had either symptoms or physical signs that could be attributed to the presence of the drug. A further observation was made by Yater which may have a significant bearing on the ultimate fate of the thorium used in this diagnostic procedure. Twenty-two of the patients who were re-examined showed evidence of mobilization of the opaque medium. The shadows of the liver and spleen appeared mottled and a portion of the thorium had shifted its position from the liver and spleen to the abdominal lymph nodes in 14 cases. The time necessary for this mobilization to occur was variable. The shortest period noted was thirteen months, and 1 patient had gone for almost five years without any apparent change in the appearance of the shadows that would indicate migration of the thorium particles. Rigler, Kouchy, and Abraham (8) reported almost similar findings in their review of 175 cases.

There can be little question as to the amount of information which can be obtained from this procedure. All who have used it have reported satisfactory shadows of the spleen and liver and found that a high degree of diagnostic accuracy can be obtained. The question of the continued use of the procedure is now entirely dependent upon the possibility of toxicity arising from the radio-activity of the ingested thorium.

Leipert (4) has made a determination of the amount of thorium retained in the body following

injection. The organs of 3 patients were examined at autopsy and he reported as follows:

A man who died two days after the injection showed that 64.3 per cent of the amount injected was retained in the abdominal organs. The second patient showed 56.9 per cent four days after injection, and the third patient showed 97 per cent sixty days after injection. Determination in rabbits showed 48.5 per cent twenty-eight days after injection, 98.8 per cent sixty-seven days after injection, and 70.9 per cent ninety-one days after injection. These figures indicate that a relatively high percentage of thorium is retained in the body.

A considerable amount of experimental work has been done in an attempt to determine the possible danger due to the radio-activity of the thorium.

Roussy, Oberling, and Guerin (10) injected 50 rats with 1 c.cm. of thorotrast every three or four days till a total of 5 c.cm. was reached. Fifteen of these rats developed tumors in a period of from twelve to eighteen months. Of 5 rats who received subcutaneous injections, 4 developed sarcomas at the site of the injection. It was noted that the sarcomatous changes appeared in close relation to the deposits of thorotrast.

Selbie (11) repeated these experiments with 60 rats. He found that histological spindle-cell sarcomas occurred in 33 per cent. Of sixty mice which received similar injections 1.2 per cent developed tumors.

The danger of delayed reactions resulting from the radio-activity of thorotrast has been studied by Taft (12). In carefully controlled experiments, in which the radio-activity was determined by means of the Geiger counter, he was able to demonstrate that the usual dose, 75 c.cm., had a radio-activity equivalent to that of 1.37 micrograms of radium element. He refers to the experiences of Martland (5, 6) who found, in a review of autopsies performed on patients dying of acute radium poisoning, a minimum of 14.0 micrograms of radium element radiation in the body. Martland reported, however, that a quantity as small as 2.0 micrograms of radium element was sufficient to cause severe radium poisoning. Taft is of the opinion that even the equivalent of 1.37 micrograms of radio-active element which is retained in the body as thorotrast may, in the course of time, produce symptoms of poisoning.

Yater is of the opinion that the absence of any signs or symptoms referable to the radio-activity of thorium dioxide is proof of its harmlessness. Selbie, however, has pointed out that Martland's work on radium poisoning proves that even in the presence of large quantities of radio-active material symptoms did not occur for at least seven years, a period longer than any thorotrast patient has been under observation.

Robins and Goldberg (9) state, concerning elimination, that neither the route nor the rate of elimination has been determined and quote Leipert (4) who was able to demonstrate the retention of thorotrast in tissues over a considerable period. The only evidence that Robins and Goldberg were able to report that indicated that the thorium may be eliminated was a slight decrease in the density of the shadows of the liver and spleen in rabbits the same time that dense granules, presumably thorotrast, were making their appearance in the gastro-intestinal tract. They conclude that while the test is of diagnostic value the potential dangers restrict its use to patients in the middle and older age groups until all question of delayed toxic reactions have been ruled out.

Kadrnka and Junet (3), in experimental work on rabbits, demonstrated that large doses of thorium which cannot be taken care of by the liver and spleen are deposited in the lungs. At first a fine mesh-like distribution was noted; later a more coarse distribution was seen which outlined the lobular elements of the lungs. Rabbits receiving these doses showed no evidence of injury in a period of observation lasting three years.

Gilbert, Junet, and Kadrnka (2) made experimental studies with rabbits. Radiation with x-rays was given which demonstrated a destruction of the liver cells when thorotrast was present, which destruction was not caused by similar doses in rabbits who did not have thorotrast deposited in the liver reticulo-endothelial system.

Cooke (1) reviewed the literature in 1934 and stated that most men are in agreement that thorotrast is eliminated very slowly, if at all, and that no active elimination can be determined in rabbits. Experimental work of his own demonstrated that daily injections of several substances, including 0.9 per cent saline solution, 5 per cent calcium chloride, 10 per cent dextrose, and 0.25 c.cm. of typhoid vaccine or epinephrin, would cause no measurable amount of elimination.

In 1932 we reported the cases of 8 patients to whom thorium dioxide sol or thorotrast had been administered intravenously as a diagnostic agent. Of these, 7 were dead as the result of pre-existing disease at the time of the writing of that article. Since that time thorotrast was given to 6 more patients, and of the entire group only 2 are now living.

In a previous communication the following observations were suggested as contra-indications to the indiscriminate use of this material:

1. The diagnostic value was definitely limited, because of the lack of clear detail in the shadows of the liver and spleen.

2. Immediate reactions, such as vomiting, subcutaneous hemorrhages, and fever, occurred on account of the toxicity of the drug in a considerable number of the cases.

3. No tendency to eliminate the thorotrast once deposited in the liver and spleen was noted in observations over a long period of time.

4. Signs of radio-activity of the ingested drug were shown by exposure of a photographic plate left over night in contact with a spleen which had been removed at autopsy from a patient who had received the thorotrast. A control spleen showed no such evidence of radio-activity.

At this time there is little to add to the story. We have followed the 2 remaining cases for a period of more than five years. Roentgen examinations made this year demonstrated that the opaque material is still retained in the liver and spleen. In neither patient has the density decreased appreciably, although we noted that at the most recent examination of one of our subjects the shadow of the thorotrast in the spleen showed a moderate degree of dissolution. Some of the opaque material had migrated to the lymph nodes so that they appeared in some profusion both in groups and following the chain up and down the spine. This migration is a new observation and explodes the theory that once thorotrast is deposited in the reticulo-endothelial system it never moves. The questions now are: To what extent does this migration occur? Is the radio-activity increased by the accumulation of thorotrast in the lymph nodes? and, Is the potential danger increased or decreased by this concentration in these nodes?

As yet no ill effects definitely referable to the thorium injections have been manifest. Possible dangers arising from the retention of a radio-active element in the body, however, have been well demonstrated, and the long period intervening between the ingestion of the element and the onset of symptoms is well known. For this reason, it is much too early as yet to dismiss this consideration.

Our early observations have been amply confirmed by Taft, Reeves and Morgan, and others, who have used the Geiger counter to directly measure the amount of radio-activity in living subjects. Further investigation along this line, as well as continued observation of the subjects who have received the drug, will in time give a definite answer to the problem.

For the present we must conclude that the intravenous use of thorium dioxide sol (thorotrast) as a diagnostic agent in the diseases of the liver and spleen is of limited value and is at least a potential source of danger.

It is our belief that careful consideration of the limitations and the dangers of this drug justify its use in only a few cases.

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PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Dahl, B.: The Inhibiting Effect of Roentgen Rays on the Formation of Callus (Nouvelles recherches sur l'effet inhibiteur des rayons de Roentgen sur la formation de cal). *Acta radiol.*, 1937, 18: 565.

In previous experiments on young rats, Dahl found that a dose of roentgen rays over the tibia of the hind leg, which caused a temporary exudative lesion of the skin followed by permanent loss of hair, was sufficient to suppress the development of callus in a subsequent fracture. If the skin lesion was less marked and followed by regrowth of hair, formation of callus was retarded and the callus was weak.

In these experiments, the bone was fractured within two months after irradiation, i.e., while the rats were still young. Observation of many laboratory animals has shown that the sexual life of rats declines when they are eighteen months old, and the age of eighteen months in these animals corresponds to the age of fifty years in man. In the series of experiments reported in this article, the rats were irradiated at the age of three months, but the tibia was not fractured until the animal was eighteen months of age and appeared old. In comparing the effect of the irradiation on callus formation in relation to the degree of skin reaction, it was found that callus formation was more definitely inhibited with the lesser degrees of cutaneous reaction in these aged rats than in young animals. With the more marked degrees of cutaneous reaction, callus formation was inhibited in both the younger and the older animals.

In another series of experiments, the rats were not irradiated until they were eighteen months of age; the leg was fractured a month and a half later. In some of these rats the effect on osteogenesis was much the same in relation to the cutaneous reaction as in young animals; in others osteogenesis was inhibited to a greater degree than in young animals with a similar cutaneous reaction.

In general it may be concluded that the osteogenetic tissue in aged animals is more radiosensitive than in young animals. This is due undoubtedly to the fact that with advancing age the regeneration of bone becomes more difficult and may be further inhibited by other unfavorable factors, such as roentgen-ray irradiation. In these experiments it has been noted that when callus formation is inhibited, the bony tissue of the diaphysis is replaced by a connective tissue as in osteitis fibrosa. There may also be a formation of fibrous bone in the marrow cavity with a certain resemblance to bone formation in Paget's disease. ALICE M. MEYERS

Coutard, H.: Results and Methods of Treatment of Cancer by Radiation. *Ann. Surg.*, 1937, 106: 584.

Coutard first pays tribute to a number of eminent American surgeons who greatly contributed to the progress of operative technique which led to improved results in the treatment of cancer, as for example, Halsted, the Mayos, Cushing, Crile, Graham, and Bloodgood.

Radiotherapy has developed more slowly but has nevertheless produced definite cures in cases incurable by surgery. The chief difficulty of irradiation lies in the fact that not all histological forms or localizations of the cancer respond equally. It appears in this respect that a classification according to the anatomical origin of the neoplasm serves a much better prognostic purpose. A knowledge of the degree of differentiation of the tumor cells and of the fibrosclerotic transformation of the vasculoconnective tissue is of particular value.

The author gives a group of statistics of cases treated in various services of the Curie Institute by roentgen therapy alone or by combined radium and roentgen irradiation (in diseases of the uterus), or by a combination of radium and surgery (in diseases of the tongue and antrum). The five-year survival rates are as follows: (a) 34 per cent of 46 cases of lymphosarcoma of the pharynx; (b) 32 per cent of 66 cases of epithelioma of the palatotonsillar region, 24 per cent of 126 cases of epithelioma of the larynx, and 11 per cent of 225 cases of epithelioma of the pharynx; (c) 50 per cent of only 8 cases of epithelioma of the maxillary sinus; (d) 31 per cent of 984 cases of epithelioma of the cervix uteri; (e) 18 per cent of 382 cases of epithelioma of the tongue; and 3.5 per cent of 112 cases of very advanced conditions in which roentgen therapy alone could be used.

If one considers the source of energy, two general methods of irradiation exist: (1) irradiation from an internal source, as, for example, radium puncture of carcinoma of the tongue or palate, intra-oral radium moulage of carcinoma of the bucca, lips, or floor of the mouth, and intracavitary radium applications of carcinoma of the uterus; and (2) irradiation from an external source, as, for example, roentgen therapy and telecurie therapy. Generally speaking, irradiation from an internal source can be used particularly in the treatment of cancer of differentiated cells, of small volume, and without adenopathy. Irradiation from an external source can be used in the treatment of extensive lesions accompanied by adenopathy, when the cells are undifferentiated or only slightly differentiated, and when the vasculoconnective tissue is soft, loose, elastic, non-fibrous and not penetrated by muscular fibers. Internal irradiation is carried out, as a rule, with a high dose in several days, whereas in external irradiation the method of continuous treatment over a longer period is recommended, as, for example, treatment with daily doses of from 200 to 250 roentgens until a total cutaneous dose as high as 7,000 roentgens is reached.

The cure of adenocarcinoma by irradiation is considerably more difficult than that of stratified

epidermoid epithelioma; therefore, operation is advised whenever it is technically or biologically indicated. Likewise, cervical adenopathies receive more benefit from surgery than from irradiation.

According to the consensus of surgical opinion, all movable cancers, or all movable lymph nodes, are operable and must be removed surgically. However, if one considers the biological indications, in addition to the technical, this opinion may suffer considerable modification. Thus, the more embryonal the neoplastic cell, as in lymphosarcoma or very undifferentiated epithelioma, the greater the probability of its dissemination and thus the less chance for a cure by operation; whereas radiation therapy may lead to a good result. On the other hand, cancers consisting of differentiated cells developing on fibrosclerotic connective tissue are radioresistant and should be treated by surgery alone. Between these extremes, there are a large number of intermediate groups in which a combination of the two methods is advised. In any combination of surgery and irradiation therapy it is more efficacious to precede rather than to follow the surgery by irradiation.

T. Leucutia, M.D.

Wintz, H.: Postoperative Irradiation Treatment of Carcinoma (Zur Strahlenbehandlung des Carcinoms nach der Operation). *Strahlentherapie*, 1937, 59: 305.

The author disapproves of the vagueness of the terms used in describing the roentgen treatment of carcinoma, and the faulty evaluations of the different methods by the individual physicians. The purpose of postoperative irradiation is the destruction of the cancerous foci which have not been thoroughly removed. Complete removal of the foci is the goal in most of the cases which have been operated upon. While partial removal of the cancer tissues in the body by operation is of benefit, there is a decreased amount of degeneration upon subsequent irradiation and consequent poisoning of the body by the products of degeneration, yet the value of the incomplete operation is questionable. The opening of the blood and lymph channels may, as a fact, lead to a very rapid dissemination and generalization of the cancerous process in the affected organism.

Irradiation of the recurrent cancer promises success only in those cases in which it is certain that there has been no dissemination from the cancer focus. When dissemination has occurred irradiation is not only useless, but harmful.

Prophylactic postoperative irradiation is that by which the transmutation of one or more epithelial cells into true cancer cells is forestalled, the cancer tissue itself having been completely removed by the previous operation. As a rule, however, postoperative irradiation is done because of insufficient operative removal of the foci. If the so-called postoperative prophylactic irradiation proves unsuccessful, it must be assumed that the cancer cells are at the time less sensitive to irradiation, or that cancer cells have been carried back into the irradiated region from outside this area.

Regarding the practical application of postoperative irradiation, the full carcinoma dose may be given at once. However, it is still to be demonstrated if the fractionated method is superior to the one-dose procedure. On the other hand, one can wait until a local recurrence, following what was thought to be a complete removal, demonstrates the need of postoperative irradiation. Better still and preferable under all circumstances is pre-operative irradiation; it has been proved unquestionably that preoperative irradiation invariably gets results in carcinoma of the breast. Operation by opening-up the blood and lymph channels may induce a dissemination, and if followed by complications the postoperative irradiation treatments may arrive too late. For these reasons such irradiation treatment is of purely limited value.

(G. Schaefer). John W. Brennan, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Davis, H. A.: Physiological Availability of Fluids in Secondary Shock. *Arch. Surg.*, 1937, 35: 461.

A study was undertaken to determine the nature and mechanism of the response of normal dogs and of animals in shock to water and electrolytes.

In a control group, it was found that the intravenous administration of 0.9 per cent solution of sodium chloride, 5 per cent dextrose, and 10 per cent sucrose each produced a rise in metabolism, the highest rates being encountered when dextrose solution was administered. The metabolism was raised from 200 to 300 per cent. However, although saline and sucrose solutions increased the metabolic rate only from 25 to 50 per cent, the rise was sustained longer. Secondary or traumatic shock, on the other hand, was accompanied by a fall of from 30 to 50 per cent in the rate of oxygen consumption.

Further studies by the author seem to indicate the presence of certain physiological and pathological limitations to the free and equal distribution of fluids in the organism in shock. The introduction of fluid into the intact animal produces a dilution of the blood with subsequent diuresis. With larger amounts of fluid, the liver cells imbibe water from the blood stream and become edematous, ultimately causing compression of the hepatic capillaries. Still later, the splenic sinusoids dilate. A transudate of protein-laden fluid into the peritoneal cavity occurs. Finally, the fluid containing serum albumin and globulin permeates through the capillary walls, particularly those of the lungs, and leads to pulmonary edema. In secondary shock the normal reservoir action of the blood for fluids is lost, and fluid leaves the blood stream more rapidly than in the intact animal. The site of fluid loss is greatest in the region of trauma, so that relatively little transudation of fluid occurs into the peritoneum or into the alveoli of the lungs. Evidences of water imbibition are present in the central portions of the hepatic lobules. The production of a lowered rate of oxygen consumption by the administration of fluids in cases of secondary shock does not result from interference with the supply of available oxygen by pulmonary edema. The stimulant action of water on metabolism is exerted only so long as fluid is actually present within the circulatory system and seems to depend on the resultant increase of blood volume or blood flow. The removal of serum albumin and globulin and of blood cells by the fluid introduced into the area of trauma and the peritoneal cavity diminishes the material available for transportation of oxygen and leads to a still greater degree of lack of oxygen.

The author concludes that in traumatic shock a peculiar alteration of the response to fluids exists. The physiological availability of water is diminished even to the point of actual intolerance. Even the transfusion of blood, as has been pointed out by Zunz and Govaerts, can be harmful. The administration of a quantity of fluid equivalent to from 5 to 12 per cent of the body weight may result in a fall in the metabolic rate. The intact animal, on the contrary, may be given fluid to the extent of 25 per cent of the total body weight without any diminution in the rate of oxygen consumption. The anoxemia of traumatic shock is augmented by the administration of fluids, which promote a loss of protein and cells into the traumatized area, into the peritoneal cavity and, to a slight extent, into the alveoli of the lungs and general tissue spaces.

JOHN H. GARLOCK, M.D.

DUCTLESS GLANDS

Oastler, E. G.: The Pituitary: Its Relation to the Endocrine System. *Glasgow M. J.*, 1937, 127: 253.

The pituitary gland has been shown to occupy an important position in the endocrine system, somewhat in the nature of a modulator, affecting and being affected by the other glands found in the system.

The posterior lobe produces pitressin and pitocin. It is probable that these are secreted in the pars nervosa itself and not in the pars intermedia. It is also possible that there is another factor that has a specific effect on the acid-bearing area of the stomach.

The pars intermedia produces intermedin, or the chromatophorotropic factor, which has a specific action of the melanophores of frogs.

The anterior lobe produces definitely eight, and probably nine, different factors: gonadotropic, (1) follicle-stimulating hormone, (2) luteinizing hormone; lactogenic; thyrotropic; adrenotropic; diabetogenic; pancreaticotropic (?); ketogenic; parathyrotropic; and growth hormone.

GONADOTROPIC FACTORS

The pituitary gland is essential for the proper development of the gonads, also for the maturation of the follicles and the phenomenon of estrus, the latter being due to the production of the estrogenic hormone.

Fevold and Hisaw, in 1933, isolated separate factors from the anterior pituitary which they claimed could bring about follicular maturation and luteinization respectively. The former they called follicle-stimulating hormone, and the latter luteinizing hormone. The former corresponds to Zondek's Prolan A, and is designated by Smith as a gametokinetic principle because it stimulates the male germ cells as well as the ova and granulosa. The luteinizing hormone corresponds to Zondek's Prolan B, and there now appears to be very little to differ-

entiate it, at least physiologically, from the luteinizing principle in pregnancy urine.

Both the follicle-stimulating and luteinizing hormones are increased in amount in certain conditions, and to such a degree that their excretion in the urine can be easily detected and measured by biological methods. The luteinizing hormone is increased during pregnancy and in cases of chorionepithelioma and hydatidiform mole. The follicle-stimulating hormone is increased after the menopause or after castration.

As regards the luteinizing-hormone fraction found in pregnancy urine the situation is entirely different. The human pituitary gland is found to contain no gonadotropic factor at all during pregnancy. This naturally suggests that this fraction must be formed elsewhere, and it now seems probable that it comes from the placenta.

In the male the pituitary gland is responsible for the descent of the testes into the scrotum and for the proper development of both the spermatogenetic and interstitial elements, the latter in turn being responsible for the development of the secondary sex organs.

In the young female the ovaries increase in size under the influence of the pituitary gland. It seems probable that both the follicle-stimulating-hormone and the luteinizing-hormone factors play a part, and that under the balanced action of the two the follicles increase in number and in size. At puberty the pituitary gland probably increases its output and this stimulates the follicles, which in turn produce, in larger amounts, estrin, in the form of the highly active substance estradiol. This result has a stimulating effect on the female secondary sex organs, the uterus, vagina, and breasts, which all enlarge. Under the continued action of the pituitary gland ovulation occurs, and the ruptured follicle becomes invaded by connective tissue and the corpus luteum is formed. This body produces progesterone.

Further complicated interactions ensue depending upon whether or not pregnancy supervenes. If pregnancy does not ensue the corpus luteum degenerates and the output both of estradiol and progesterone falls, which occurrence probably is the determining factor that brings about menstruation. The falling-off in the secretion of the ovarian hormones stimulates the pituitary gland once again and so another cycle is started.

On the other hand, if pregnancy occurs the anterior-pituitary-like substance is produced almost immediately after implantation, from some part of the outer surface of the ovum.

LACTOGENIC FACTOR

An association between the anterior pituitary lobe and a factor essential for lactogenesis was first discovered in 1928 and 1929. The lactogenic factor or prolactin has no effect on the development of mammary tissue. It merely induces the secretion of milk, and can act only on a gland that has first been suitably prepared. Lactation can be brought about experimentally both in male and female animals by preliminary injections with estrin and progesterone, followed by prolactin.

THYROTROPIC FACTOR

A connection between the pituitary gland and the thyroid has been known to exist clinically for some considerable time. Thyrotoxicosis has been observed repeatedly in cases of acromegaly. In cases of this disease in which the basal metabolic rate was high, removal of a chromophil adenoma has been followed by a fall in the rate almost as uniform and as striking as that seen after thyroidectomy in a case of Grave's disease. On the other hand, Simmond's disease showed the opposite picture, and other types of hypopituitarism have also been shown to be associated with hypothyroidism frequently.

Experimental evidence has shown that hypophysectomy in all sorts of species, such as the tadpole, the dog, and the rat, has been followed by atrophy of involution of the thyroid with an excess of colloid and a low epithelium. The basal metabolic rate fell to as low as minus 35 per cent. These changes could be prevented or repaired by implanting pituitary gland. The opposite effect, hyperplasia of the thyroid, was produced by injections of extract from the anterior pituitary lobe.

ADRENOTROPIC FACTOR

There is considerable clinical evidence of an interrelationship between the adrenal gland and the pituitary gland. Atrophy of the adrenal cortex has been described in cases of hypopituitarism, and cortical hypertrophy in acromegaly.

Experimentally it has been found that after hypophysectomy the adrenal cortex atrophies, the medulla not being affected, and that this atrophy can be prevented or repaired with pituitary implants. It has also been shown that the extraordinary power which the adrenals have for compensatory hypertrophy is lost at once after hypophysectomy. On the other hand, injection of extract from the anterior pituitary lobe has resulted in hypertrophy and increase in weight of the adrenals.

There is also evidence which indicates that the atrophy of the gonads that occurs after removal of the adrenals takes place through the pituitary gland.

DIABETOGENIC FACTOR

The relation between the pituitary gland and diabetes has been recognized for a long time. Glycosuria and fully developed diabetes mellitus are very frequent occurrences in acromegaly. On the other hand, in hypopituitarism the sugar tolerance is much increased, and hypoglycemia may occur, even severe enough to produce serious symptoms.

Houssay was the first to demonstrate the direct relationship between the pituitary gland and the pancreas, and to prove the existence of a diabeto-

genic factor with an antagonistic action to insulin. Houssay showed that whereas a pancreatectomized animal developed diabetes and died, an animal whose pituitary gland was removed previously, or at the same time, failed to develop severe diabetes. The diabetogenic factor is quite independent of the thyroid, the adrenals, or the gonads, since it acts in the absence of all these glands. It has been separated from the thyrotropic factor and also from what is known as the ketogenic factor.

The way in which this factor acts is obscure; its presence appears to be necessary for the action of adrenalin in discharging glycogen from the liver.

PANCREATICOTROPIC FACTOR

The existence of a pancreaticotropic factor with a direct stimulating effect on the islets of Langerhans is extremely doubtful, and the general opinion at present appears to be that there is no adequate proof of its existence.

KETOGENIC FACTOR

It has been shown that an injection of an alkaline extract of the anterior lobe of the pituitary into animals kept on a fat diet resulted in a temporary increase in the excretion of acetone by the urine, and an increase in the ketone bodies in the blood. It is now generally agreed that the effects are due to a specific hormone, orophysin or the ketogenic hormone or factor.

This hormone is usually found together with the thyrotropic principle in the preparation of extracts of the anterior pituitary lobe, but it appears to be quite separate from the latter, and is quite distinct from the diabetogenic factor, both chemically and in its biological actions.

PARATHYROTROPIC FACTOR

The existence of a parathyrotropic factor is suggestive but not yet definitely proved. A possible relationship between the pituitary gland and the parathyroids is suggested by the descriptions in the literature of cases of pituitary basophilism. Many of the clinical signs and pathological findings in pituitary basophilism suggest a close resemblance to the condition of hyperparathyroidism.

GROWTH HORMONE

Growth and the pituitary gland have been connected ever since Marie showed that acromegaly was associated with pituitary disease. One of the most obvious effects of hypophysectomy in young animals is the cessation of growth immediately after the pituitary gland has been removed. It is now known that these effects are due to a specific hormone in the anterior lobe. Pituitary extracts will maintain growth in young animals after hypophysectomy, but will have little or no effect on the atrophy of the other glands. If administered to normal animals great acceleration of growth results, and in the rat, an animal whose epiphyses remain open for a very long time, veritable giants have been produced.

ANTITROPIC FACTORS

It has been observed that repeated injections of a tropic factor will soon result in a diminution of the original stimulating effect and eventually in hypoplasia. This was first noted in respect to the thyrotropic factor, and, later, the gonadotropic and others. It is not known where these inhibitory substances are formed, but since they can be developed in hypophysectomized animals, they cannot come from the pituitary gland.

Collip believes that these inhibitory substances are true antitropic hormones, and states that he has found them occurring spontaneously. He has suggested that they probably exist normally in the body but that they cannot be detected until they exceed the hormone substance with which they are balanced.

This conception of Collip's is by no means universally accepted. Many investigators consider that these inhibitory substances are of the nature of antibodies and can be explained on an immunological basis. J. THORNWELL WITHERSPOON, M.D.

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